SCIENTIFIC AMERICAN

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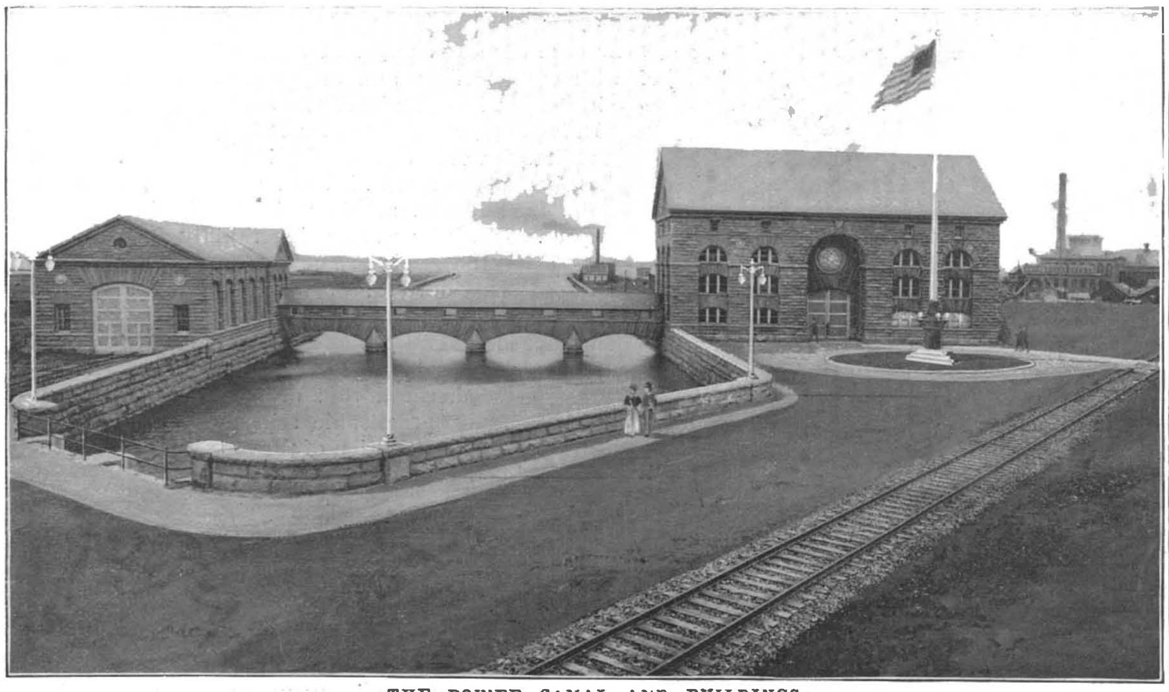
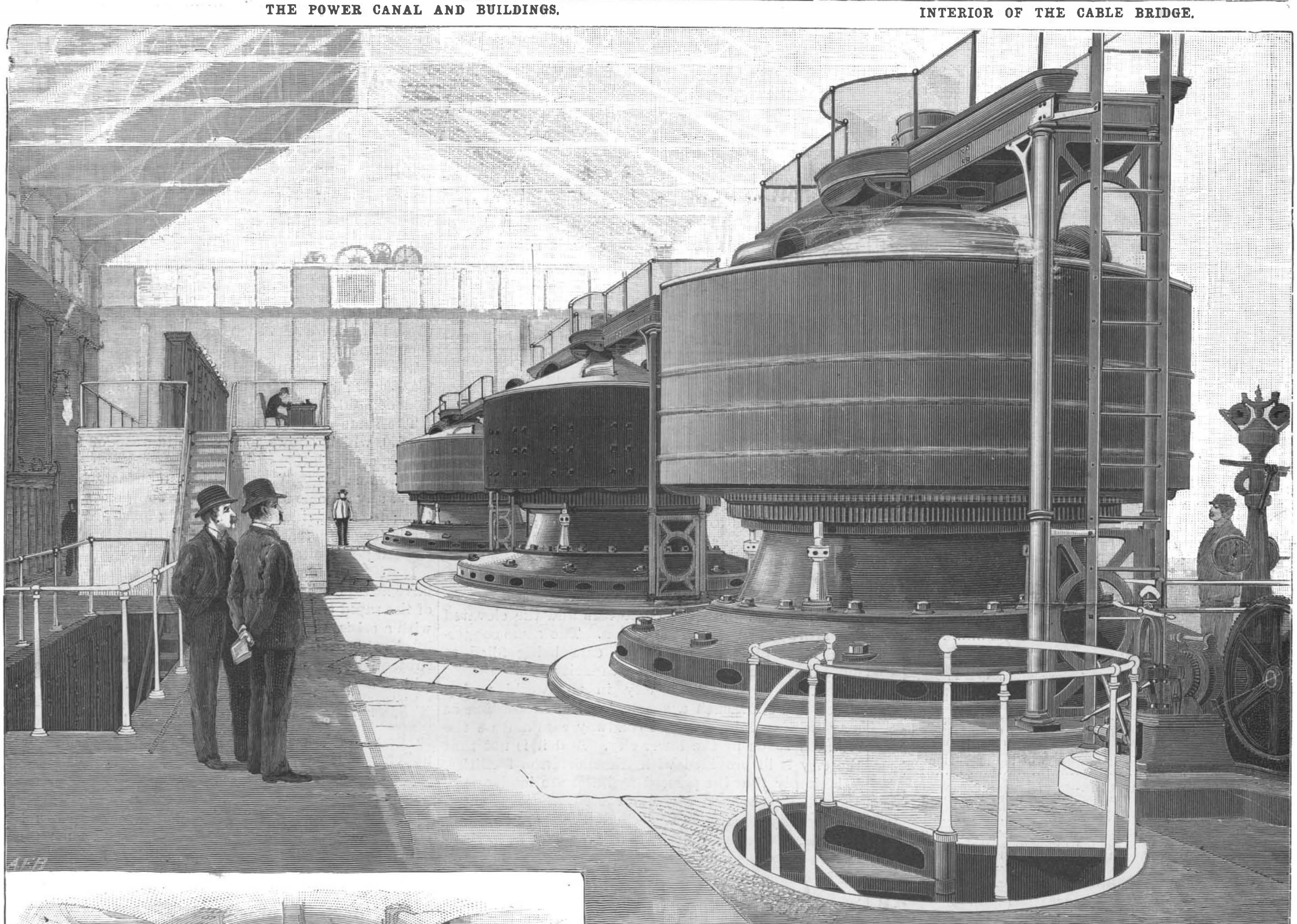
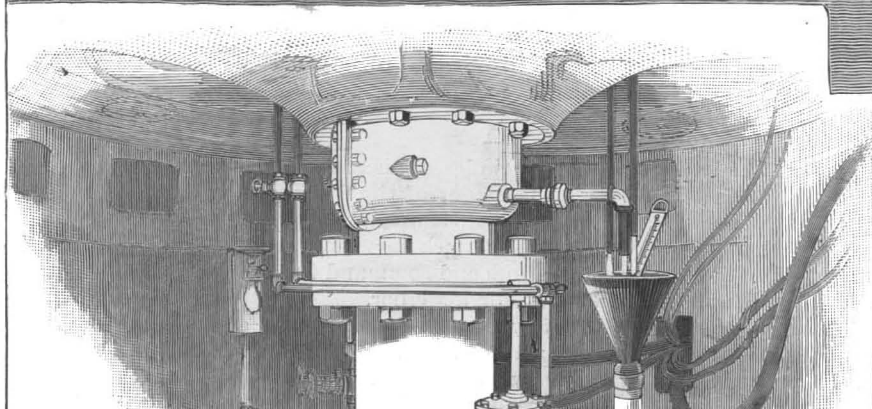
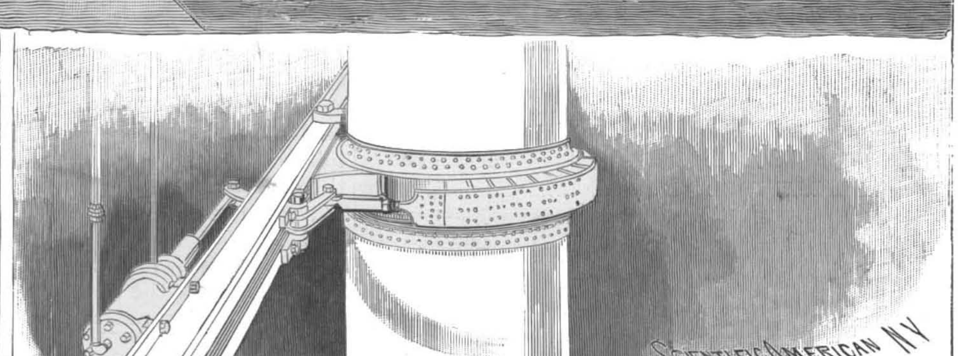


THE POWER CANAL AND BUILDINGS.

INTERIOR OF THE CABLE BRIDGE.







OILING AND COOLING PIPES. THE DYNAMOS. THE FRICTION BRAKE.

THE NIAGARA FALLS POWER PLANT.—[See page 55.]

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NEW YORK, SATURDAY, JANUARY 25, 1896.

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(Illustrated articles are marked with an asterisk.)

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SCIENTIFIC AMERICAN SUPPLEMENT

No. 1047.

For the Week Ending January 25, 1896.

Price 10 cents. For sale by all newsdealers.

THE TRANSPORTATION PROBLEM IN NEW YORK CITY.

There are certain elements entering into the problem of rapid transit in New York City which render its solution perplexing and difficult as compared with the same problem in other great cities, such as London, Paris, Chicago, Berlin, or Philadelphia. These difficulties arise partly from the topography of the site upon which it stands and in part from the character and tastes of its inhabitants. For it is certain that the American temperament would find any system of subterranean transportation uncongenial; and such of us as may have chanced to ride upon either the Metropolitan or the District Underground Railways in London, or the Underground Railroad in Liverpool, have set down the experience as one of the "bad dreams" of our life. The greater height, breadth, and roominess of the American as compared with the European railroad car is to be attributed to the national love of light, air, and freedom; and this same disposition will always lead the city traveler to avoid a tunnel route, if any alternative above-ground system be available.

It is true that the two underground railways above mentioned can scarcely be taken as illustrating the best possibilities of underground travel. They were both pioneer enterprises of their kind; they are worked by steam locomotives, and they are at all times badly ventilated and poorly lighted. The use of the electric locomotive would, it is true, go far to remove one objection, and electric lighting the other; but no possible refinements of modern invention can remove the prejudice which does and probably always would exist in New York against such a system of transportation, on the ground that it was located below, and not above, the surface of the city.

The objection is a purely sentimental one, but it exists; and it constitutes one of the elements that make the transit problem in New York so perplexing. For it is certain that in the underground tunnel, placed well below the level of sewers, water mains and electric wiring, free to follow the avenues of traffic, and radiating at will from the centers of business to the outlying suburbs, we have the theoretically perfect system.

In the city of London they are elaborating an underground system—driven to it by sheer necessity—and it is likely that the Southwark electrically worked tunnel will prove to be the forerunner of a vast system, which will spread like a network below the metropolis. It is probable, however, that for New York this "dernier ressort" of congested city traffic is not available.

It is to the peculiar topography of the site upon which New York is built that we must look for an explanation of the present rapid and alarming congestion of traffic. New York City proper is built upon a site which may be approximately described as a narrow parallelogram, some 14 miles in length, and of an average width of 1¾ miles. At the extreme southern end of this parallelogram is situated the heart of the city—its most important business center. During a space of two hours in the morning the flow of traffic sets in southward toward this business portion of the city. It commences in the northern suburbs, 15 to 20 miles distant, and rapidly gathers volume as it moves to the south, traveling at first over the elevated roads and later over the elevated and the cable and horse car lines combined. Many miles before the lower city is reached this stream of humanity has overflowed the available means of transportation, and both the cable cars and the elevated trains are crowded to suffocation. The same congestion takes place at night, the cars being filled to more than double their seating capacity.

There is probably no city in the world to-day which can show such a spectacle of overcrowding as may be seen daily on the Broadway cars and on the elevated roads in the lower city. And it is not that the city is ill provided with transportation facilities. It is simply that the present facilities are inadequate. Indeed, we question whether there is another section in any city of the world where there are so many trips occur per square mile in a given time as in Manhattan Island.

The overcrowding is to be traced to the fact that the bulk of the traffic to and from the city is hemmed in between the waters of the East and North Rivers. Judged from the standpoint of transportation facilities, the ideal location for a great city is that which on all sides affords uninterrupted communication by rail and car line with the outlying districts. The business center can then receive and disgorge its multitude of toilers along lines of travel which radiate from it, as the spokes from the hub of a wheel. Each radial line of travel in such a case has this advantage over parallel lines of travel, such as obtain on Manhattan Island: that the area served by such lines increases as the square of the distance traveled, and the distribution of its passengers will be proportionately rapid.

Nor can it be urged that the ferry service on the two rivers and on the bay provides a radial service similar to that of an inland city. For it is a well established fact in the economics of transportation that travel will always favor a rail in preference to a water route; and the truth of this rule is made manifest in the excessive crowding on the Brooklyn Bridge as compared with that which obtains at the various ferries. The astonishing increase of travel across the bridge is a fact whose significance must be borne in mind when we are devising some means of relief from the present intolerable congestion. The reduplication of the Brooklyn Bridge, either alongside or near the present structure, and the erection of other bridges across the East and North Rivers, would provide New York with radiating lines of travel which could land their passengers in the heart of the lower city and distribute them at night with great facility and dispatch, and in many cases without the inconvenience of a change of car.

In looking broadly at the whole question of transportation it would be consoling if we could feel assured that, bad as the case is, it has reached its worst stage. Unfortunately the statistics which we give below prove very clearly that we are going rapidly from bad to worse; and that, unless some emergency scheme of relief be quickly devised, the main avenues of traffic will soon be hopelessly paralyzed!

We are indebted for the following figures to a recent article on the bridging of the North River by Mr. Gustav Lindenthal, the author of the original and evidently the most practicable scheme for bridging the North River; the location of the crossing being in the neighborhood of Twenty-third Street and Hoboken, N. J.

BROOKLYN BRIDGE TRAFFIC.

1884	8,823,000
1894	43,000,000
In 1882, total ferry passengers	41,000,000
In 1895, total ferry and bridge passengers	135,000,000

NORTH RIVER FERRY TRAFFIC.

1886	58,894,000
1894	85,000,000

ELEVATED RAILROAD TRAFFIC.

1879	46,045,000
1884	96,703,000
1890	185,833,000
1893	*221,407,000

* The last available figures.

It will be noticed that whereas during equal intervals of time the ferry traffic has doubled itself, that of the elevated roads has multiplied itself two and one-half times, and that across the bridge no less than five times; a fact which establishes the statement we have made above, to the effect that travel will always seek a rail in preference to a water route. It should also be noted that the number of people that travel is gaining upon the means provided for their transportation at a rapidly increasing ratio; and, furthermore, that the increase is most rapid along those lines of travel which are already most seriously encumbered.

The total street railroad traffic in 1887 amounted to 164,000,000; and this, distributed among a population of 1,107,000, gave 148 trips per capita.

The same class of traffic in 1894 amounted to 460,000,000, which shows a per capita rate of 250 trips among a population of 1,840,000.

Here we are confronted with another fact which must affect any scheme for the relief of the present congestion; for it is evident that not only must provision be made for an increase of population, but also for an increased per capita travel.

It will be evident from the considerations which we have advanced in this brief review of the present state of the rapid transit problem that we are face to face with a crisis, which in the near future will beget an intolerable amount of delay and discomfort. In a subsequent issue we shall indicate the lines along which a temporary relief may be realized—a relief which shall last during such time as may be necessary for the bridging of both rivers; and, if it should prove to be an ultimate necessity, the construction of an underground railway.

THE OVER-SUPPLY OF ELECTRICAL ENGINEERS.

It is characteristic of the alertness and restless activity of the age in which we live that no sooner is a promising field of enterprise opened than it is quickly flooded with a surplus of labor and capital. The old time conservatism, which baffled the early efforts of Fulton, Howe and Morse, has been succeeded by a lavish expenditure of wealth and toil in the promoting of new inventions, as they from time to time appear.

In the choice of his calling the son no longer treads in the footsteps of the father; but, impelled by the keen competition of the hour, he rather seeks out that line of work in which he will meet with least competitors and command the highest possible remuneration for his labor.

Shortly after the opening up of any new industry there will be found at its doors a large and increasing army of more or less qualified applicants, who have been attracted by the high scale of wages that is paid at the outset for skilled labor. The supply soon exceeds the demand. There is a simul-

taneous fall in the rate of wages proportional to the amount of surplus labor available.

Of all the great industries which have had their birth and development in recent years, there are none that have promised richer prizes, or drawn into their service a larger and more enthusiastic army of workers, than those which have grown out of modern discoveries in electricity. Rapid as has been the growth of electrical engineering, however, it already appears that the supply of trained electrical engineers in much in excess of the demand; and that the rate of pay in electrical engineering is already some twenty per cent less than it is in civil or mechanical engineering.

The current number of the Engineering Magazine contains an article by Mr. Henry Floy on the question as to whether we are not educating too many electrical engineers. In order to verify the fact of over-production, he sent 260 personal letters to the present year's graduates of Cornell and Lehigh Universities and the Massachusetts Institute of Technology. The larger part of the graduates made reply.

Subjoined is an extract from the letter of an electrical graduate: "I have made application by letter to about one hundred of the leading manufacturers and railway companies. The letters received kind attention, yet I cannot but think that most of the positions secured must have been created through the influence of relatives and friends." Another graduate received a number of discouraging replies to his application for an electrical position. He then wrote "two more letters, in which, among other things, I mentioned my knowledge of shorthand and German. Both of these letters brought answers asking an interview. As a result, I have my present position."

The results of the replies are shown in tabulated form below:

	Electrical. Per cent.	Mechanical. Per cent.	Civil. Per cent.
Replies received	48·1	39·4	48·1
Of those who replied, the following secured employment	78·8	75·0	71·8
Secured employment in the line of work in which they studied	65·0	71·4	87·1
Secured employment through influence of relatives	21·1	10·7	11·1
Secured employment through influence of friends	15·3	32·1	35·8
Average pay per week	$10.70	$13.52	$13.27

Two significant facts in this table should be noted by those who contemplate entering the electrical engineer's profession: First, that the fewest electrical engineering graduates, relatively, secured work in the particular line in which they had studied; and, secondly, that the electrical graduate is paid from 20 to 23 per cent less than the mechanical or the civil graduate.

Professor Routgen's Wonderful Discovery.

There have been received from Europe by cable very insufficient accounts of a discovery attributed to Professor Routgen, of Wurzburg University. By the use of a radiant state of matter tube, a Crookes tube, it is stated that he has succeeded in obtaining photographic effects through opaque objects. It has long been known that ether waves of long period would pass through matter opaque to short waves, and that such a screen as is afforded by a plate of blackened rock salt will sift out short waves, while long waves pass through it. In some unexplained way Professor Routgen, it is claimed, has succeeded in affecting the sensitive plate with waves which had passed through an opaque body. Metals cutting off all rays alike would produce a shadow, so that a metallic object in a box or embedded in the human system could be made to give some kind of an image. The operations are said to have been conducted without a lens, entirely by shadow.

This is about the substance of the reports. It is yet too soon to indulge in the wild possibilities that have been suggested for the process. When the details reach us, the process will probably prove to be of scientific rather than of practical interest.

A New Horseless Carriage Race in France.

The Automobile Club, of Paris, have arranged a race which is to take place in June, the course being from Paris to Marseilles and return. One of the conditions laid down for the race is that the contestants are to proceed only in the daytime. The carriages are to be divided into two classes, the first having two to four places, and the second series is for carriages having greater passenger accommodation. This club has decided to secure a villa in the Bois du Boulogne, Paris, as a branch of the Automobile Club for use during the summer.

A gentleman was recently summoned in England for using a horseless carriage without causing a person to rpoceed it with a flag. It was contended for the defense that the carriage was not a locomotive, but the presiding magistrate considered that the apparatus could be converted into a locomotive, as it was capable of drawing another vehicle. The magistrates decided that the motocycle was a locomotive, but as this was the first case of the kind, they imposed a nominal fine of one shilling and costs. The lawyer for the defendant says that a special act of Parliament will be required to render the use of such vehicles legal.

The Meeting of the American Society of Civil Engineers.

The forty-third annual meeting of the American Society of Civil Engineers began January 15, in the Church Building at Twenty-third Street and Lexington Avenue, New York City, a few doors from the club house. There were about one hundred delegates present and George S. Morison, of Chicago, who presided, called the meeting to order. The report of the committee on time reckoning at sea was taken up and fully discussed. A resolution was adopted asking the President of the Senate and the House of Representatives to accept and approve the resolutions of the International Conference which assembled in 1884, and to act in conference with other nations to cause the Nautical Almanac of the United States to be brought into harmony with these resolutions at the beginning of the twentieth century. Various addresses were made and visits were paid to the central station of the United Electric Light and Power Company, to the works of the Crocker-Wheeler Electric Company, at Ampere, N. J., to the Brooklyn Bridge and elsewhere. A reception was given at Delmonico's on the evening of January 16. It was announced that the society has purchased two lots at the junction of Broadway and Eighth Avenue, where they will erect a beautiful structure as the headquarters of the society. About $400,000 will be spent on the building.

The society has now an active membership of 2,000, so that its present quarters are much too small.

The following was the result of the election of officers for 1896: President, Thomas Curtis Clarke, New York; vice presidents, William R. Hutton, New York, and P. A. Peterson, of Montreal; treasurer, John Thompson, New York; directors to serve three years, First District, George Alexander, New York; William Barclay Parsons, New York, and Horace Lee, New York; Third District, John R. Freeman, Boston; Sixth District, T. W. Symons, Portland, Ore.

Sea Water for London.

A bill has been prepared to lay before Parliament and estimates made for the work necessary to bring sea water to London, for use in public and private baths, and for road watering and sewer flushing, should the authorities deem it best to make such use of it. The company to undertake the work is arranging to supply ten million gallons daily, taking the water from the ocean at a point near Brighton, about fifty miles almost directly south of London. The intake pipe would run some distance out to sea, and near the pumping station would be a reservoir to serve as a settling tank, from which the water would be pumped to a near-by reservoir on a hill 500 feet high. No more pumping would then be necessary, the water flowing thence by gravity to London, but there would also be a storage reservoir at Epsom, 240 feet above the sea level, and water flowing from there to London would have sufficient pressure to carry it to the top stories of high buildings. It is said that in several English towns, as Plymouth, Yarmouth, Portsmouth, Torquay, Birkenhead, and others, sea water is now used for sewer flushing, and the Lancet speaks favorably of such use of sea water, claiming it to be a piece of extravagance that water sufficiently pure for drinking purposes, and obtained at high cost, should be employed for the mere conveyance away of sewage. But it will be remembered that a similar employment of sea water in New York City, which has unrivaled advantages for its most efficient use at a low cost, has been adversely decided upon, although it was for many years strongly urged by some of our leading citizens. The Board of Health, in particular, took strong ground against it as detrimental to the public health and likely to cause and promote the spread of diphtheria. Such reasons, however, are not applicable to the use of sea water in bathing lakes and swimming baths, and the luxury of a sea water bath in private houses, which such a system would afford, would probably be largely availed of. For such uses alone it is probable that the supply the new company proposes to bring to London will find ample use. Ten millions of gallons of water per day is not much for a city like London, with its four to five millions of inhabitants, when it is remembered that in New York City our average daily consumption of water supplied by the Croton system is now 200 millions of gallons.

Automobile Carriages in Paris.

M. Roger, the inventor and manufacturer of automobile carriages, has made application to the police authorities of Paris for permits to run a number of horseless carriages on the streets; for hire at the regular legal rate of 30 cents a drive or 40 cents an hour when hired on the street; when hired from a cab stand the charge is slightly greater. That horseless carriages can be run cheaply enough to compete with the regular fiacres is thus shown.

Polarization Investigations.

The polarization of the light emitted by incandescent bodies has not yet been fully investigated. Arago, indeed, made some experiments on incandescent iron, platinum, and glass, but these were only qualitative, and did not extend to liquids. Mr. R. A. Millikan publishes, in the Physical Review, an account of some careful tests of light emitted by glowing solids and liquids with a view to discover the laws of its polarization. This phenomenon is exhibited strongly by incandescent platinum, silver, and gold, and by molten iron and bronze. A somewhat feebler polarization is shown by copper, brass, lead, zinc, and solid iron. The most significant result is that polarization is minimum with rays emitted normally to the surface and maximum at a grazing emission. This indicates that the vibrations take place in a plane at right angles to the emitting surface. To show the phenomenon at its best a smooth surface is essential. Glass and porcelain also emit polarized light, but to a lesser amount. Fluorescent bodies do the same, so that evidently a high temperature is not necessary. In the case of uranium glass it is the green reflected light which is polarized, and not the blue incident light diffused from the surface.

New Cavalry Weapon.

Captain George H. Paddock, of the Fifth United States Cavalry, is the inventor of a new gun for that branch of the service, which should prove both handy and effective. This weapon, suggested by Captain Paddock, is to be built on the same general plan as the new gun being constructed for express guards, and resembles a sawed-off repeating shotgun, with barrels 22 inches long and bored to target a charge of buckshot inside a circle 50 inches in diameter at 50 yards.

Cavalry armed with Captain Paddock's weapons would, on hearing the command "Charge!" draw their guns from the scabbards and, cocking them, bear down upon the foe. When within range each gun would discharge a cone of scattering buckshot, spreading from the muzzles of their pieces to circles 50 inches or more in diameter. Thus, both in height and length, the line of the enemy would be completely covered with missiles.

Lately, in a gun built especially for sheriffs, Captain Paddock has found a breech and reloading action which, applied to his "charge pistol," answers all requirements. This gun has all its mechanism about the breech. To reload it, the trigger guard is drawn backward along the grip, and the old shell is ejected and a new load inserted with a minimum of movement, and with no projection of arms or levers up or down from the piece. Its reloading also can be accomplished with one hand; a firm hold of the trigger guard and a jerk or throw are all that is necessary; the weight or inertia of the piece "does the rest."

The weight of the gun is just five pounds, while the mechanism, being in the butt or back of the breech, like the heavy hilt of the saber, gives balance to the weapon, so that it can be raised, lowered, and aimed in one hand with facility. Another advantage possessed by the new action is ease in reloading on a restive horse. The jerking of the bridle rein was apt to interfere with working the ordinary reloading grip that slides on the magazine, when grasped by the bridle hand, as it must be when used in a cavalry charge. With the improved "charge pistol," however, such jerking is actually a help to the soldier, facilitating the operation of reloading this new gun by aiding the weight or inertia of the piece in sliding it forward from the reloading grip, which alone is grasped by the right hand when working the breech action.

Progress with the Chicago Drainage Canal.

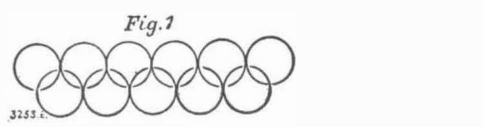
Reports recently submitted to the trustees of the Sanitary District of Chicago show that work on the big drainage canal to date amounts to 75 per cent of the whole. During the months of August, September and October last there were over 8,700 men at work on the canal. The report of Chief of Engineers Randolph shows that the value of the regular and collateral work done in the period between January 1 and December 1, 1895, eleven months, is $6,036,400. The volume of work done in this period is as follows: Glacial drift, 7,187,600 cubic yards; solid rock, 4,824,000 cubic yards; retaining wall, 95,000 cubic yards.

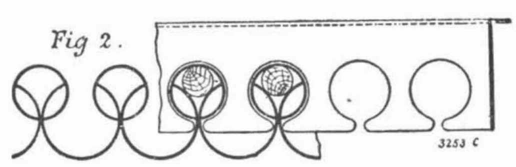
The total volume of work accomplished since the inception of the project is as follows: Glacial drift, 20,172,686 cubic yards; solid rock, 10,212,751 cubic yards; retaining wall, 97,600 cubic yards. The value of this work on regular and collateral contracts is $14,456,600, or 76·20 per cent of the entire work done upon a basis of existing contracts. The percentage of work done on January 1, 1895, was 44·38, so the percentage of work done in the first eleven months of 1895 amounts to 31·52, or within 12·56 per cent of the total work done in 1892, 1893, and 1894.—Marine Record.

A CHICAGO lawyer of a cynical disposition thus defines a promoter: "One who sells nothing for something to a man who thinks he is getting something for nothing."

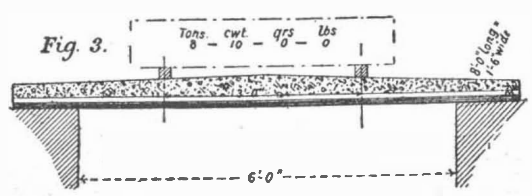
PEASE'S TUBULAR CONSTRUCTION.

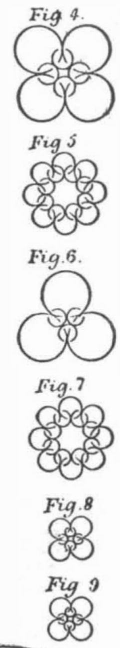
Pease's tubular construction is founded on one of those exceedingly simple ideas which appear self-evident as soon as they are seen, and yet are quite novel. The conception on which it is based is that three incomplete tubes, that is, tubes formed by bending strips into a circle, but not welding or otherwise connecting the opposing edges, can be interlocked with one another, so as to make a fairly firm structure. The number of tubes that can be connected in this way is not, however, limited to three. That is the minimum number, and there is no maximum. If, in addition to the stiffness obtained by the interlocking of the tubes, their interiors be filled with concrete, there is produced a structure of very great rigidity, in which the metal tubes supply the tensile strength which the concrete lacks. It is well known that concrete will take such a firm hold of iron as to fully utilize the strength of the latter.

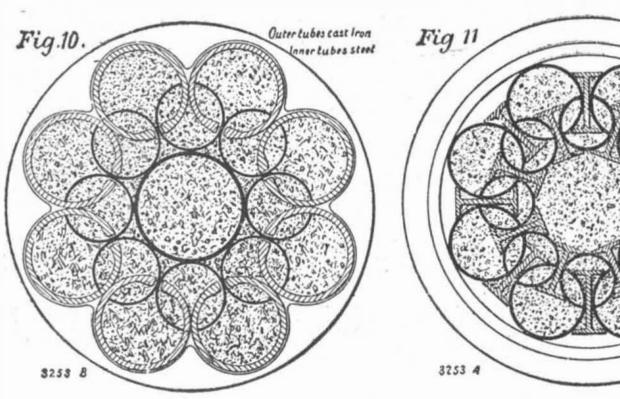


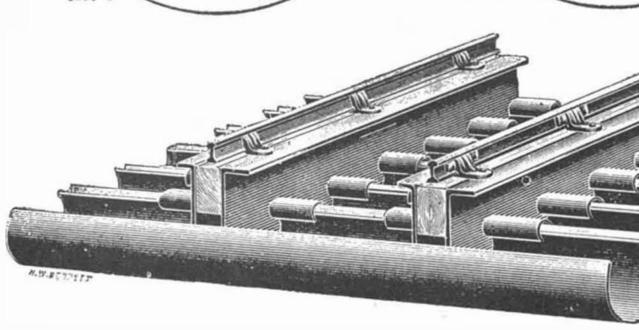


Longitudinal Section of Bridge Flooring.









PEASE'S TUBULAR CONSTRUCTION.

From time to time we have given reports of the strengthening of concrete slabs by iron bars and wires with most satisfactory results, but in no case have the conditions been so favorable for perfect adhesion as in the construction before us. There are, however, a great many cases in which simple interlocked tubes give ample strength without any kind of filling. For instance, in Fig. 1 is shown a form of construction well adapted to form walls and roofs of temporary buildings, in substitution of corrugated iron. The tubes are of 24 Birmingham wire gage, and 2 inches, 4 inches, 6 inches, or any other diameter. Of course, a wall or roof built in this way is heavier than one of corrugated iron, but it offers considerable advantages, both in hot and cold climates, from its non-conducting qualities. Each tube forms an air cell, while the points of contact between the inner and outer rows of tubes are so small that they do not offer much opportunity for the direct transmission of heat from one to the other. Further, the tubes may readily be filled with moss litter, chaff, sawdust, or other non-conducting material, and thus there will be produced, at small cost, a building that it will be possible to live in with a fair amount of comfort in tropical climates. The same type of construction is adapted both for roof and walls; the former is perfectly watertight, even if laid flat, and all the rain must find its way into the lower row of tubes and run out at their ends.

It is not necessary that the tubes should be all of the same size, and in some cases there may be a saving of material by adopting two different diameters, as shown in Fig. 2. This is marked as a section of bridge flooring, but it also does excellently well for walls or partitions which have to be plastered inside. If the larger tube be almost filled with straw, the quantity of plaster required is reduced, while at the same time a good key is provided. Whatever design of wall be adopted, it has the advantage of perfect portability. As there are neither bolts nor rivets used, a building may be put up and down a score of times without damage to the materials.

Figs. 2 and 12 show a flooring without rivets. It will be seen that it is made of two different sizes of tubes, and that it is further stiffened by wooden keys. The bar with the holes in it is threaded on at an angle to secure further rigidity. A floor of this description is shown under test in Fig. 3. Over the metal there was applied concrete, making the depth 5 inches over all. The span was 6 feet and the width 1 foot 6 inches. A load of 8 tons 10 cwt. was applied as shown, giving 19 cwt. per square foot of floor, while the weight of metal was 22 pounds per square yard, or 2·45 pounds per square foot, equal to a plate 1/15 inch thick. The floor broke down under the load, the iron tearing clean in two. The deflections were as follows: 1/16 inch with 3½ tons; 3/16 inch with 6½ tons; and 1½ inch before breaking. In another test made by Messrs. David Kirkaldy & Son, four tubes 3 inches in diameter were joined by three tubes 2 inches in diameter, and were covered with cement to a total thickness of 5⅝ inches. A load was applied at the center over a span of 6 feet, and the ultimate stress was 5,387 pounds. A beam, made of three 4 inch tubes, united by two others of the same size, and all filled with concrete, carried, on a 6 foot span, 6,042 pounds applied at the center before the iron parted from the cement; it failed entirely at 7,822 pounds. In every case the iron was 24 Birmingham wire gage. Figs. 4 to 9 show several kinds of columns built up from tubes according to the methods of Pease's construction. Fig. 4 shows a column composed of four 2 inch tubes and four 1 inch tubes. Filled with concrete, it weighs 16 pounds per foot, and a length of 95½ inches failed under a load of 22,048 pounds.

Fig. 5 comprises eight 1 inch tubes and eight ¾ inch tubes, and weighs 11 pounds to the foot. Its load was 18,080 pounds. Fig. 6 has three 2 inch tubes and the same number of ¾ inch tubes. Its weight is 11·9 pounds per foot, and its crushing load, on a length of 95·5 inches, 17,882 pounds. Fig. 7 has eight outer tubes 1 inch in diameter and eight inner of ¾ inch diameter. It carried a crushing load of 15,864 pounds on a length of 95·8 inches, and failed, as did all the others, by buckling. Fig. 8 is built of 1 inch and of ½ inch tubes, and weighs, filled, 4·6 pounds per foot. Its load, on a length of 72·3 inches, was 11,268 pounds. Fig. 9 is practically the same as Fig. 8. On a length of 46 inches it carried 7,517 pounds.

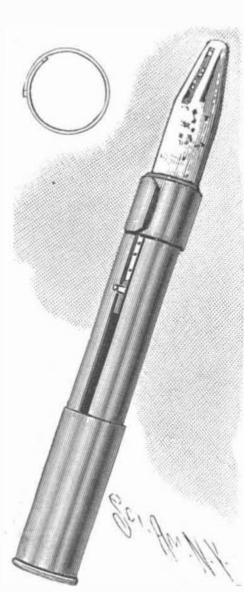
Figs. 10 and 11 are more ambitious structures. The former is a suggestion for a bridge pier, combining the advantages of cast iron on the outer surface with a steel and concrete core. The latter shows a column in which, in addition to steel tubes, double channels are employed to give greater strength and rigidity.

As regards the simpler forms of this sheet metal tubular construction, it must be conceded that they furnish a new material for which many uses may readily be found. The weight of metal employed is exceedingly small, while the forms in which it is used give it the maximum of strength. Already a boiler chimney has been erected in the form of a reeded column (Fig. 6), with a non-conducting lining, and other uses are being tried almost daily.

We are indebted to London Engineering for the particulars and the engraving.

STOCKER'S CHALK HOLDER.

The simple device shown herewith, for conveniently holding a piece of chalk for writing or drawing, has been patented by Albert A. Stocker, of Dixon, Ill. It consists of an open-ended tube, slotted from end to end, a tubular cap fitting over either end of the tube, and there being in the tube a friction slide on which is a pin projecting through the slot. A clamping band of spring metal, as shown also in the small figure, serves to draw the tube or casing into sufficiently firm contact with the chalk.

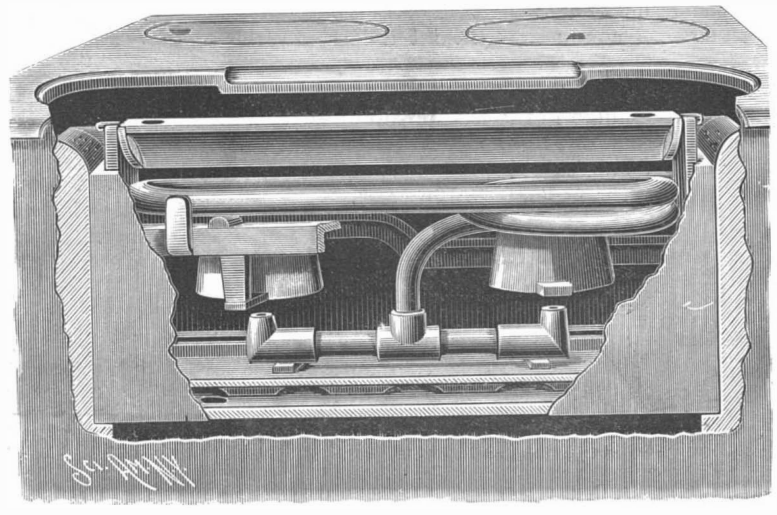


Locomotive Performances.

The Railroad Gazette recently gave details of a recent trial of compound and simple engines on the Chicago, Milwaukee and St. Paul Railroad. A Baldwin compound stood first. Two compounds beat the simple engines singly and collectively, and the choice of them is only a question of mechanical preference, considering the point of simplicity and durability. The simple engines figure out an average mileage of 28,170 miles per year, and the demonstrated saving of 16·6 per cent would mean about 245 tons of coal saved in a year. At the price of $2 per ton for coal, the saving would amount to $490 for each engine per year.

A GAS GENERATOR AND BURNER.

A device adapted to be placed in the firebox of a stove ordinarily burning wood or coal, and be connected with an oil supply, for generating and burning gas as fuel instead of wood or coal, is shown in the accompanying illustration, and has been patented by Charles R. Clark, of No. 435 State Street, Chicago, Ill. The box or casing is cut away at the rear, that the flame and heat may more readily reach and heat the stove, and the necessary air is admitted through bottom openings. Integral with the ends of the base plate are standards, on which are secured the lugs of a frame, adapted to carry the generating coils and mixing cones. The generating tube, entering at one side near the top, passes entirely around the interior of the box, and then forms a lower coil around one cone, passing thence to a central T at the bottom, provided with gas-emitting nozzles, the burning gas from which is thus directed upwardly into the region of the generating pipe. The frame also supports, immediately above each burner, a mixing cone, adapted to confine the gas and mix therewith the amount of air necessary for its most efficient combustion. Extended upward from the standards at each end are arms forming bearings for the trunnions of a deflector plate whose bottom has a central rib, the surfaces at the sides of which are curved in the arc of a circle, it being intended, by the swinging of this plate, to direct the flame against the oven side, as desired. It is the purpose of the lower coil, around one cone, to superheat the gas before it reaches the burner nozzles, and thus obtain better results from its combustion.

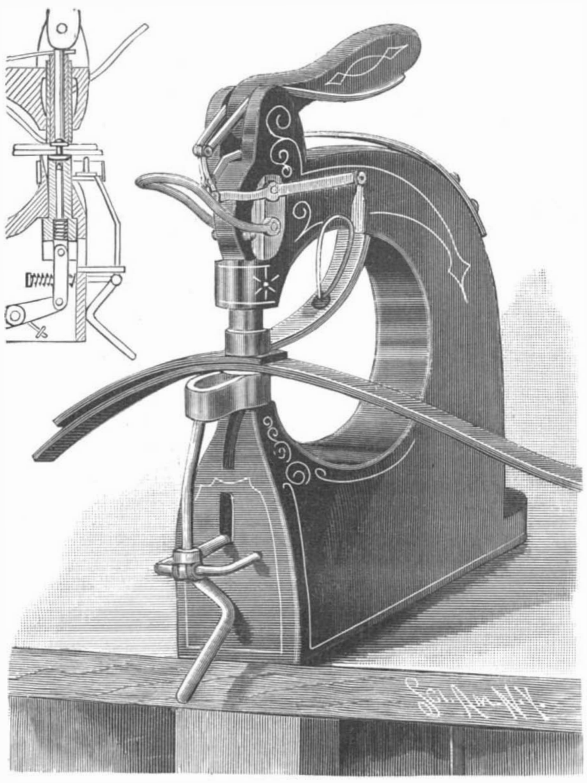


CLARK'S GAS GENERATOR AND BURNER.

MR. A. S. WALBRIDGE, of Mystic, Canada, has been a subscriber to the SCIENTIFIC AMERICAN for 49 years.

A LEATHER RIVETING MACHINE.

The machine shown in the accompanying illustration has plungers or rods to puncture the material, insert the rivet and washer and upset or head the end of the rivet shank. It has been patented by Christian A. Skeie, St. Hilaire, Minn. The small figure is a central sectional view. The presser plunger, which moves vertically in the arm of the machine, is tubular, and moving vertically in it is a washer-holding plunger,



SKEIE'S RIVETING MACHINE.

also tubular, to receive an inner riveting plunger. A spring plate attached to the upper side of the arm has a forked outer end surrounding the upper end of the riveting plunger and bearing upon the washer-holding plunger, the spring forcing the plunger down on a washer. Pivoted to the outer end of the arm is a hand lever for forcing the riveting plunger downward, and pivoted also at the same point is a bifurcate lever adapted to be rocked in one direction by the hand lever. Communicating with a side opening in the lower portion of the plunger is a curved washer chute, the washer being held in place in the chute by a spring finger, which yields sufficiently to allow the washer to be forced forward by a pusher connected to a pivoted lever whose other end has a pivoted link connection with the bifurcate lever, so that the washer may be fed by the operation of the hand lever which forces down the riveting plunger. Moving in line with the plunger, in a tubular portion of the base, is an anvil whose lower end has a link connection with a pivoted rock arm, the lower end of which is connected by a link with a driving power or foot treadle. A puncturing tool or awl is movable vertically in the anvil, and the lower end of the tool is attached to a yoke plate in such manner that, by the interposition of a coiled spring, the puncturing tool may be moved upward to puncture the leather without moving the anvil upward. Connected to a yoke whose arms extend through holes in the hollow base is an upwardly extending rivet pusher finger, movable in a slot in the bottom of a rivet tray, the finger being moved to push a rivet into position by a depending angle lever handle.

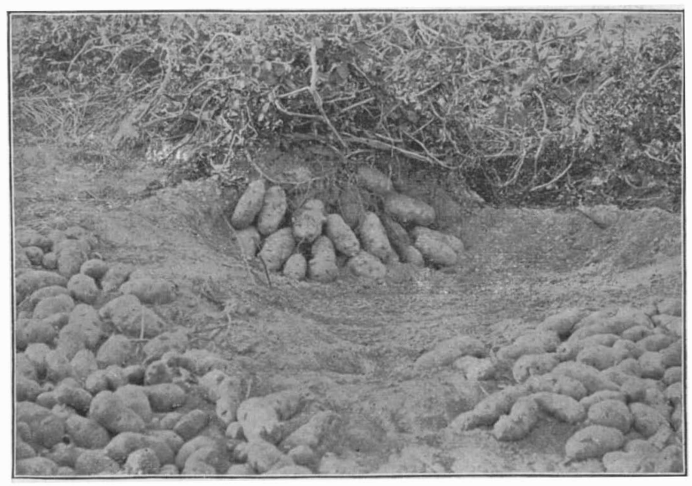
To place the work in position for riveting, the plunger is raised by a forwardly extending, curved, yoke-like handle, the plunger being then allowed to return to bear upon the yoke. The bifurcate lever is then rocked to push the washer down upon the work, and the treadle is operated to punch the hole, the rivet being forced into position by the angle lever handle; the anvil is then pushed upward to force the shank of the rivet through the perforation, and the hand lever is moved to force the riveting plunger down upon and upset the end of the rivet.

REMARKABLE POTATO GROWING.

Mr. C. E. Ford, of Rusk, Texas, who writes that he has been taking and has kept files of the SCIENTIFIC AMERICAN for thirty years, sends us a photograph, from which the accompanying picture was made, and gives us particulars of the remarkable success he has achieved in raising potatoes. The potatoes he prefers for forcing are of the Early Rose variety, the vines or stalks growing 6 to 8 feet, and but seldom blooming or having balls. The Triumph is said to make a crop quicker than the Early Rose and to stand the dry weather better. Mr. Ford believes in "intensive" culture, or the higher fertilizing and increased labor on a small piece of land, rather than little labor and fertilizing on a large tract. He sprouts his potatoes to the size of English peas or marbles before planting and then raises a crop in from four to six weeks, all of large size, without a peck of small potatoes to an acre. He writes:

"There were forty seed the size of peas planted to every double hill. I plant my potatoes in the water furrow and leave a balk 4 to 6 inches wide, and when the potato seed is dropped on the balk a part of the seed fall on each side of the narrow balk. I cover with two furrows of turning plow. I make my rows 3 feet apart; the hills 18 inches apart in row, which makes 140 hills across an acre and 70 rows to the acre makes 9,800 double hills of potatoes to the acre, or 19,600 single hills. As you will see, a hill of 40 seed potatoes goes across the balk, making the hill cover some 18 inches, or half the ground. I never plant less than 20 and have planted 60, and the 60 will every one make as fine potatoes if we have plenty of rain. I also give my potatoes fertilizing with liquid manure every rain. It takes from 60 to 75 potatoes to make a bushel, never more than 75. I have kept the same seed for 26 years and have potatoes both sweet and Irish the whole year round.

"By sprouting your potatoes you have eating potatoes in less than one-half the time it takes under the old style of planting. It takes from four to six weeks to sprout the seed potato to the size of peas; the sprout room I keep warm by a small charcoal fire in a bake oven. One barrel of charcoal will be plenty for the whole time. I put my potatoes into old barrels or small boxes, so as to get them warm easier than in a big heap or bunk. The smaller the boxes, the easier and quicker they will sprout. When the potatoes get large enough, I knock off the hoops, take down the staves, and there are thousands upon thousands of small potatoes from the size of a bird's eye to that of peas and a few the size of marbles; the whole mass is held together with small roots. I take a hand barrow (not a wheel barrow) and carry the seed down the row, and the third person breaks off as many as you wish—not less than twenty to forty—and let them fall on the balk in the water furrow and give two plowings. My sprout house has double walls and is filled in between with sawdust, also overhead, and has double doors."



EARLY ROSE POTATOES—3000 BUSHELS TO THE ACRE.

STEAM AND SOLAR HEAT.

La Nature recently published a description of a vessel found at Pompeii with an internal fire box provided with tubes. The discovery of this apparatus or of another analogous to it dates back twenty years, for the Revue des Deux Mondes mentions it in its number of September 1, 1866.

Seneca, in his Natural Questions (vol. iii, p. 24) speaks of the Draco, a sort of boiler formed of a large spiral tube placed against the interior walls of the cylinder forming the furnace.

Heron, of Alexander, is still more explicit, and, in his Pneumatics, describes the very arrangement of the Pompeiian apparatus under the name of Miliarion, a Greekized Latin term applied to the heat generator in general on account of its resemblance to a milestone.

I was the first to give a French translation of this description in a volume now out of print. I give a summary of it here with the aid of a figure that has been skillfully restored by our draughtsman from the simple line drawing of Heron, and which shows, besides, the arrangement indicated by the Alexandrine engineer for producing one of those effects of amusing physics of which the ancients were so fond. Fig. 1 shows in the center the furnace in the form of a vertical cylinder. All around there was a boiler, likewise cylindrical, filled with water. A certain number of tubes, such as K, M and N, put its different parts in communication in passing through the furnace and thus increasing the heating surface.

The cock, T, served to draw off hot water and the cup, L, to introduce cold water into the boiler through a tube running to the bottom of the latter. The object of the bent tube was to allow of the escape of the air when water was poured in and to give exit to the steam that might be produced. In this way was prevented the projection of water through the cup, L. In the figure is seen a closed compartment into which the water did not enter, and which was designed to set in motion various figures through the aid of steam and a several way cock. This cock consisted of two concentric tubes capable of revolving, one within the other, with slight friction. The external tube, A, was fixed to the top of the heat generator, through which

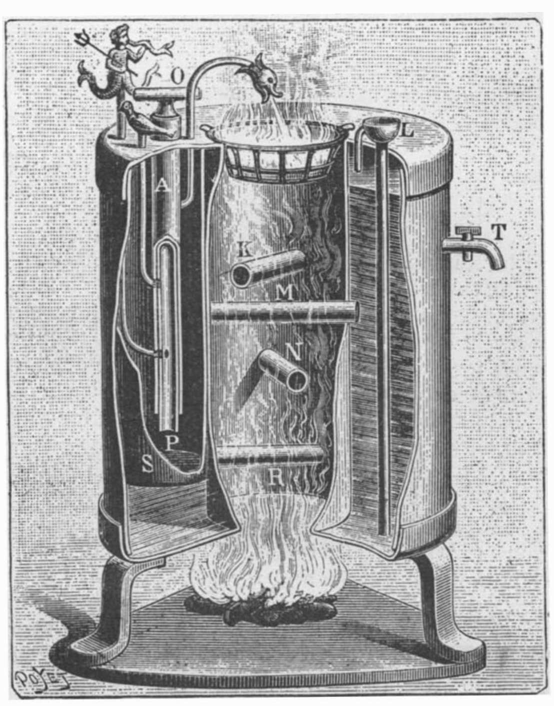


Fig. 1.—HERON'S TUBULAR BOILER.

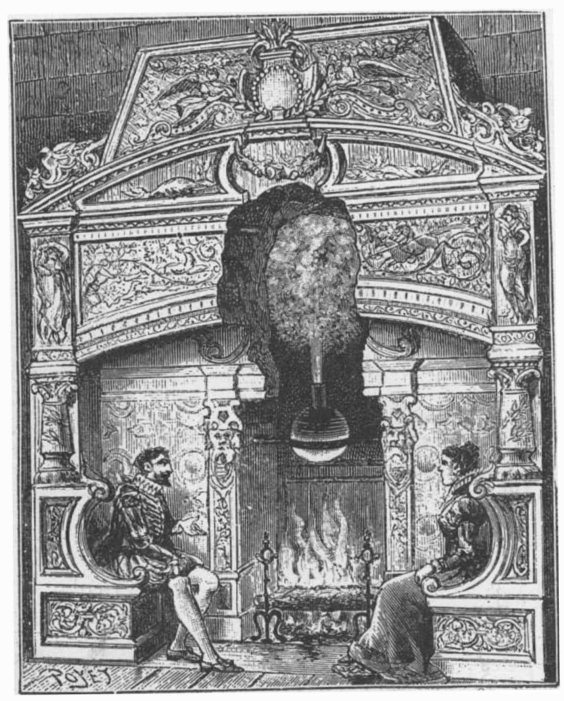


Fig. 2.—EOLIPYLE CHIMNEY.

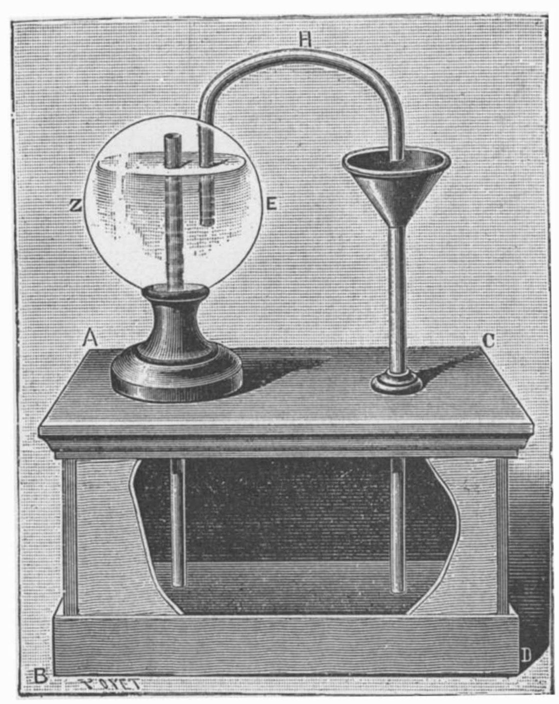


Fig. 3.—THE SOURCE.

it passed and descended vertically into the interior. It was provided with three apertures placed at different heights and communicating through small tubes with the figures to be spoken of hereafter. The internal tube, P, was open at the bottom and thus communicated with the interior of the compartment. It was closed at the upper part, which debouched above the generator and which was capable of being maneuvered with a handle, O. It was provided with three apertures at the same heights as those of the external tube, but pointing in a differing direction, so that when, through a rotary motion of the tube, P, one of its apertures was brought opposite an aperture in the tube, A, of the same height, the two others did not correspond. Marks made upon the visible part of the two tubes showed the positions that it was necessary to give in order that such correspondences should take place. One of the small tubes terminated in a snake's head which was apparently looking into the furnace. The second ended in a triton holding a trumpet in the mouth. Finally, the third carried at its extremity a whistle that debouched in the body of a bird full of water.

It will now be seen what occurred. The tube, T, was removed and a little water was poured into the closed compartment. This water flowed into the tube, R (which passed into the furnace and was closed on the side opposite its opening in the closed compartment), and was converted into steam. After the tube, P, had been replaced, it was possible at will to cause the steam to pass into the body of the bird, which would warble, or into that of the triton, which would sound the trumpet, or into the head of the serpent, which would blow upon the fire and quicken the flame.

It has been asserted that steam was employed by means of the eolipyle, in the fifteenth century, in the mines of Joachimsthal (Bohemia) for revolving a windlass designed to draw up ore from the shafts. It is certain that in France, even before that epoch, the idea had been conceived of utilizing steam. The following, in fact, is what Vincent de Beauvois says apropos of Gerbert: "He constructed, according to the principles of mechanics, a clock and some hydraulic organs into which the air, introducing itself in a surprising manner, through the force of heated water, filled the cavities of the instrument, and, escaping through brass tubes, rendered modulated sounds at their thousand apertures."

Returning to the eolipyle, we find it recommended by Philibert Delorme for preventing chimneys from smoking. "By another invention it would be very well to take a copper ball or two, 5 or 6 inches or more in diameter, and, having made a small aperture above, to fill them with water and then put them in the chimney at a height of 4 or 5 feet, or thereabout (according to the fire that one desired to make), in order that they might become heated in proportion to the amount of fire reaching them, and, through the evaporation of the water, cause such a draught that there would be no great amount of smoke that would not be driven out through the top." . . . "And, in order that you may better know how they should be applied to chimneys, I give a figure hereafter for the front of a chimney, as well as for the interior, so that it may be easy for you to know how they must be placed and heated, and also how they expel the smoke" (Fig. 2).

It had occurred also to Heron to utilize the heat of the sun for raising water, and the apparatus of Porta was certainly inspired by the following passage borrowed from the Pneumatics of the Alexandrine engineer:

"The apparatus, called the 'source,' allows the water to flow as soon as it is struck by the rays of the sun (Fig. 3). Let A B C D be a base through which passes a funnel whose tube extends to within a short distance of the bottom. Let E Z be a globe from the top of which starts a tube that runs to the bottom of the base. Let H be a siphon, and let us pour water into the funnel. When the sun shines upon the globe, the air that it contains, being heated, will expel the liquid, and the latter, led by the siphon, H, will flow through the funnel into the base. But when the globe is placed in the shade, the air passing through the sphere, the tube will take up the liquid again and fill the vacuum that has been produced therein; and this will occur every time that the sun enters it."

It will be remarked that Heron explains the effect of the condensation of the air in the globe by the exit of the molecules rendered sufficiently tenuous, through the effect of the heat, to traverse the pores of the glass. He expresses this opinion, moreover, apropos of cupping glasses. "The fire that is placed therein," says he, "destroys the air contained in them, just as it consumes other bodies (water or earth) and converts them into more tenuous substances." And, a little further along: "Water also, when it is consumed by the action of fire, is converted into air, for the vapor that rises from a heated kettle is nothing more than the molecules of water, rendered more tenuous, that pass into the air." Salomon de Caus (Les Raisons des Forces Mouvantes, Paris, 1624, Livre I, Prob. xiii) improved Heron's little apparatus and described it under the name of the "Continual Fountain."

It is generally thought that the materiality of the air was not recognized until the seventeenth century. This is an error, and the following is the way in which Philo of Byzantium demonstrates it in his Pneumatics:

"If I take an empty vessel (or supposed empty, in common opinion), wide in the middle and narrow at the top, like the amphoras manufactured in Egypt, and if I immerse it in water having a sufficient depth, hardly any water will enter it until a portion of the air makes its exit, and the entrance of the water will not occur until after the exit of the air. This is the way in which I demonstrate it. Let us take a vessel with a narrow neck, as I have indicated, at the bottom of which has been formed a small aperture that is closed with wax. Let us afterward invert the vessel in water of sufficient depth, in taking care to hold it erect. Then let us immerse it with the hands until it is completely submerged. If we remove it gently by degrees, we shall find it dry in the interior, and none of its parts save the neck will have been wet. Hence it is clearly shown that the air is a body. If, in fact, it were not a body, and if the internal cavity were empty, the water would flow in without anything occurring to prevent it. In order to show this still better, let us immerse the said vessel and with the same precautions, and let us remove the wax that closes the aperture, and the exit of the air will at once become perceptible. If the aperture is below the level of the water, we shall see bubbles in the water, and the vessel will become filled with water on account of the exit of the air through the aperture. What necessarily causes the air to make its exit is the movement and pressure due to the water when the latter enters the vessel."—A. De Rochas, in La Nature.

Natural History Notes.

An Incombustible Tree.—The Gardeners' Chronicle gives some interesting details concerning a tree of Colombia which truly merits the name of vegetable salamander. This tree, the Rhopala odorata, of the order Proteaceæ, presents a remarkable power of resistance to fire. In the district of Rolima it is customary every year, during the dry season, to set fire to the plains in order to destroy all the dry weeds that, during rains, might interfere with the growth of the young and tender vegetation. This periodical conflagration naturally produces the most disastrous effects upon the trees, which gradually disappear without being replaced, since it is difficult for an old tree to resist, and still more so for a young shoot of one or two years. A single tree forms an exception, and that is the one above mentioned—the Rhopala. Small, distorted, and scraggy, and having a wild and desolate appearance, this tree not only does not suffer from the fire, but derives profit therefrom. It gradually establishes itself in localities abandoned by other trees and installs itself therein. We have here a very topical case of a survival of the fittest. It, alone capable of resisting fire, witnesses the disappearance of its rivals, and is seen to gradually encroach upon an always more extended domain. Its resistance to fire is due to its bark. The external portion of the latter, more than half an inch thick and formed of dead cells and fibers, acts like a protective jacket with respect to the more central and living parts, and it is this that assures its triumph in its struggle for existence against fire.

Sense of Sight in Spiders.—Professor and Mrs. Peckham, in continuing their studies of spiders, have published in the Transactions of the Wisconsin Academy of Sciences some extremely interesting observations upon the sense of sight. Concerning the range of vision the authors think their experiments "prove conclusively that Attidæ see their prey (which consists of small insects) when it is motionless, up to a distance of five inches; that they see insects in motion at much greater distances; and that they see each other distinctly up to at least twelve inches. The observations on blinded spiders and the numerous instances in which spiders which were close together, and yet out of sight of each other, showed that they were unconscious of each other's presence render any other explanation of their action unsatisfactory. Sight guides them, not smell."

The authors also experimented with the color sense of spiders, and reached the opinion that "all the experiments taken together strongly indicate that spiders have the power of distinguishing colors."

Wasps and Suicide.—A short time ago, Mr. Henry, a Frenchman, being curious to see the effect of benzine upon wasps, put some of it under a glass in which one of these insects was imprisoned. The wasp immediately exhibited signs of great annoyance and anger, darting at a piece of paper which had introduced the benzine into its cell. By and by it seemed to have given up the unequal contest in despair, for it lay down upon its back, and, bending up its abdomen, planted its sting thrice in its body, and then died. Mr. Henry allowed his scientific interest to overcome his humanity so far as to repeat the experiment with three wasps, only to find that the two others acted in the same manner. He is, therefore, of the opinion that wasps, under desperate circumstances, commit suicide.

An Insect Parasite of Books.—Mr. E. A. Schwarz, in Insect Life, describes the Nicobium hirtum, an insect of the family Ptinideæ, and which, indigenous to Southern Europe, has recently invaded the United States. This little insect inhabits old books, and its range in Europe seems to be quite limited. It has evidently been brought thence with the large quantities of old European books that are shipped to this country for public or private libraries. A large number of old editions have crossed the ocean in this way, and, very naturally, the parasites of such volumes have crossed it likewise. There is mentioned a Louisiana library of eight or nine thousand volumes of which, in all likelihood, it will be necessary to burn a portion in order to save the rest and prevent it from being invaded by the destructive insect. No efficient means of destroying it are known. It would seem, however, that certain fumigations ought to effect the object.

The Oldest Rose Bush Known.—The oldest rose bush in the world is found at Hildesheim, a small city of Hanover, where it emerges from the subsoil of the Church of the Cemetery. Its roots are found in the subsoil, and the primitive stem has been dead for a long time, but the new stems have made a passage through a crevice in the wall and cover almost the entire church with their branches for a width and height of forty feet. The age of this tree is interesting both to botanists and gardeners. According to tradition, the Hildesheim rose bush was planted by Charlemagne in 833, and the church having been burned down in the eleventh century, the root continued to grow in the subsoil. Mr. Raener has recently published a book upon this venerable plant, in which he proves that it is at least three centuries of age. It is mentioned in a poem written in 1690, and also in the work of a Jesuit who died in 1673.

Influence of Low Temperature Upon Fishes.—The sudden and total freezing of watercourses, as sometimes observed in northern countries, is usually regarded as the fatal cause of the death of all their inhabitants. Mr. P. Regnard thinks that such a belief is not borne out by the facts. Having progressively refrigerated the water of an aquarium, he found that, toward 0°, a carp seemed to go to sleep, that it no longer moved its fins, and that its gills moved but slightly. At —2°, the animal seemed to be fast asleep, but had not frozen. Finally, at —3°, it was in a state of apparent death, but still perfectly limber. When the temperature was then slowly raised, the carp awoke and seemed in nowise to have suffered. This is a proof that the polar seas, which never descend to a temperature below three degrees, are perfectly capable of giving asylum to living animals, which become acclimated to such low temperature.

Are Animals Left or Right Handed?—Mr. David Starr Jordan communicates an article on this subject to the November number of the Popular Science Monthly. It is well known that left-handedness has often been observed in animals. According to Vierordt, parrots seize objects with the left claw by preference or exclusively. The lion strikes with the left paw and Livingstone tells us that all animals are left handed. Mr. Jordan was desirous of verifying this statement as regards the parrot. He observed that this bird makes a readier use of the left claw for climbing upon the finger that is offered to it. But it must be observed that most people being right handed, it is the right hand that is offered to the animal, and as in most cases one places himself just opposite the animal, it results that it is rather the left than the right claw that he solicits. And what shows this is that, upon offering the left hand to the animal, the latter in most cases extends the right claw, which is the nearest However, Mr. Jordan finds that there is a slight preference for the use of the left claw, and he explains it by the fact that the habit of having to do with right-handed persons has developed a preference for the use of this claw. Evidently, in order to solve the question, it would be necessary to observe parrots in a state of liberty and without fetters, and that had not been trained by man, and to see what claw they use by preference for the habitual acts of life—for commencing to climb, for example, and for seizing their food, the latter being placed in positions of easy access and not requiring the use of one claw rather than the other by reason of the position that the animal is obliged to assume in order to reach it.

A CURIOUS ice formation recently attracted a good deal of attention in the river just below the falls at Lewiston, Me. There are strong eddies in the water, and the combined action of wind and currents during the hard frost has caused the formation of a great wheel of ice about two hundred feet in diameter, perfectly circular, and rounded smooth on the edge. This great ice wheel swings slowly and continuously round and round in the circling current of water at the foot of the falls.

THE NIAGARA FALLS ELECTRIC POWER PLANT.

The operations of the Niagara Falls Power Company have on several occasions been illustrated and described in our columns. The original designs have been in some respects departed from, owing to the great advance in the scope of electric engineering, and the plan, as matured, has taken largely the shape of the production and sale of electric power, but hydraulic power is still furnished if desired.

A surface canal has been excavated leading inward from a point on the Niagara River a few miles above the falls. Nearly two hundred feet below the surface of the ground a tunnel has been driven which from a point almost directly beneath the inner end of the canal runs beneath the neck of land and opens on the bank of the Niagara River below the falls, and near the Clifton Bridge.

A large rectangular wheel pit has been excavated at the side of the canal, connecting with the tunnel. Large steel pipes or penstocks lead from the canal down the wheel pit nearly to its bottom, where the water is delivered under a head of about 140 feet to turbines situated almost on the tunnel level. These turbines generate the mechanical power, and from the turbines shafts rise through the pit vertically to the surface. Over the pit the power house has been constructed, within which the electric energy is generated. One of our small cuts shows the power canal.

On the right hand is seen the power house, a massive stone structure with flag staff in front of it. Crossing the canal is a bridge, designed not only for use by the staff of the works, but also for carrying the cables, and on the left side of the canal is seen a second stone building, to be used for transforming the potential of the system.

The interior of the bridge, with its cable racks on each side, is shown in another of the small cuts. When it is remembered that there are installed in the present power house several five thousand horse power polyphase electric generators of the most advanced type of construction, and that for the manipulation of the currents a most elaborate switching system is required, that adjuncts for the operation include elaborate lubricating devices, governors, electric elevators, an electric fifty-ton crane, exciters and transformers, it is evident that the space at our disposal is inadequate to give more than a general idea of the great installation.

Referring now to the large cut, three of the great generators are shown in it, which are placed on a line parallel with the axis of the rectangular wheel pit, which goes down nearly two hundred feet into the earth beneath them. In the distance is seen the electric crane for mounting or dismounting the parts of the machinery. To the left is seen the elevated switchboard. Several staircases give access to the floors or decks over the pit, and two electric elevators are provided for carrying the workmen up and down the wheel pit.

The generator presents the peculiarity of having a stationary armature and a rotating field. The field surrounds the armature, the latter being almost hidden from sight, and the rotation is effected directly by the turbine.

The generators, which may be termed a genuine triumph of electrical engineering, are of the Tesla vertical type, and were built by the Westinghouse Electric Manufacturing Company. For each generator there is a turbine wheel. The axis of the generator comes directly in line with the axis of its own turbine, situated 150 feet below it. From the turbine rises a steel shaft, whose upper end passing up through the center of the generator carries on its top a concave disk-shaped mass of cast steel. To the disk is secured a solid weldless ring of nickel steel, in itself a metallurgical triumph, which ring is the base of the field. The ring, which is 11 feet 7⅛ inches in external diameter, was made from a single ingot of nickel steel, 4 feet 6 inches in diameter at the bottom and 16 feet 6 inches long. A hole was drilled through its center and a piece of proper size was cut off, expanded and forged and turned into shape.

To the interior of the great field ring, field poles are secured, each, with their winding, weighing 2,800 pounds. In the center of the ring is the armature, whose core is built of thin sheets of mild steel all annealed with consequent oxidation, which oxidation is relied on to break up the electric continuity, so as to dispose as far as possible of the Foucault currents. The armature conductors consist of copper bars $\frac{13}{32}$ by $\frac{11}{16}$ inch in section, and insulated from each other principally by mica. As the armature is stationary, no collectors are used, the cables coming directly from the winding. The numerous pole pieces of the field have their coils supplied with current from a direct current exciter or generator, and its current is transmitted to the rotating field by collecting rings, thus exactly reversing the ordinary role of the parts.

It is calculated that the maximum speed which could be imparted to the ring is 400 revolutions to the minute, which gives a very large factor of safety (13:48); at double this speed it is calculated that the ring would burst, but its resistance to the centrifugal force is to a certain extent increased by the magnetic pull exerted by its pole pieces upon the armature core. This magnetic pull would operate to increase the centrifugal strain were the field stationary and the armature in rotation.

On the upper part of the dynamos will be seen little hoods. As the armature rotates, these are drawn rapidly through the air, the motion creating an out draught from them, cooling the structure, for it is calculated that heat equivalent to 100 horse power may be produced as a waste effect in the operation of the dynamo.

The weight of each generator is 170,000 pounds, the field representing 79,000 pounds. Each generator is of about 5,000 electric horse power and has a potential of 2,000 to 2,400 volts with 25 cycles or reversals per second. This is at a speed of rotation of 250 turns per minute. To produce this energy 5,150 horse power are expended on driving the turbines. As a graphic way of putting the compactness of the machine, it is stated that the entire dynamo could be placed in a room 15 feet square and 15 feet high. The journals of the shaft are kept constantly oiled by a never ceasing flow of oil under a pressure due to its own head. This oil, after passing through the journals, is filtered and returned thereto. Water also circulates about the bearings to insure coolness, and the temperature of the liquid is constantly watched in order to ascertain when any heating occurs. One of the cuts shows the funnel through which the oil is delivered from the bearings with a thermometer in it to show if any heating is taking place. Finally, the cut illustrating a section of the steel shaft also shows a friction brake used to stop the turbine. If the governing gate at the bottom, which is employed to shut off the water, be closed, a sufficient leakage occurs to keep the machine in rotation, and the brake is relied on to check the slow rotation due to such leakage.

In the transformer house which is seen to the left of the canal are to be established step-up transformers for raising the potential to perhaps 20,000 volts for transmission of energy to Buffalo. At present the plans for this transmission have yet to be developed. When electric energy is transmitted to Buffalo, the Niagara plant will have reached a high level of development.

Removal of Tattoo Marks.

Various methods suggested for removing tattoo marks have appeared from time to time in these columns. The following, mentioned by the Paris correspondent of the Lancet-Clinic, seems new: The principle of the method is to form a dermic destruction of the tattooed part. Here is how it is done: It is first necessary to paint over the tattooed marks with a concentrated solution of tannin; afterward, by means of fine needles, we make a series of pickings over the tattooed design. Over the surface thus picked we pass a stick of nitrate of silver. At the end of a few minutes we see detached the black pickings previously made, and know that the superficial layers of derma contain a tannate of silver. In order to assure success this surface must be powdered with tannin two or three days. The end is very simple. After an inflammatory action, lasting two or three days, the picked parts turn black, forming a thin crust, very adherent to the deeper skin, but painless. At the end of from fourteen to eighteen days the scab falls off, and in its place a superficial red mark is seen, which gradually fades away until, at the end of a few months, all signs of coloration disappear. Dr. Baillot also suggests the use of binoxalate of potassium in place of nitrate of silver. Of course, antiseptic precautions are all taken in performing this operation, and the old tattoo needle is used to remove all tattoo marks.

Spectacular Effect of an Electric Tower.

A curious effect in lighting at the Atlanta Exposition has provoked some discussion as to its æsthetic propriety. There were very beautiful electric fountains on the Clara Meer, but the thing that attracted equal if not greater attention was a towering column afloat on the bosom of the lake, above which it rose to a height of thirty feet. The column, which was of graceful proportions, rested on a broad platform, and this in turn was supported by a lot of unseen oil barrels, contributed for the purpose by the Standard Oil Company. All around the white shaft, and up into its capital, ran spirals of small incandescent lamps, which were on different circuits, and could be readily flashed in and out. Current was led to this tower of light from the shore by means of about 600 feet of submerged cable. The result was quite weird, and greatly puzzled the colored brother, who saw the tower "winking" at him across the water; while the artist and architect do not know whether to praise heartily or condemn roundly a solid tower swaying lightly on the water, and sending out its bright beams with curious mirage effect. This odd experiment, says the Evening Post, was due to Mr. Luther Stieringer, the consulting electrical engineer of the exposition, who also designed the electric fountains at the World's Fair, and it is suggestive of many new applications of electricity to spectacular marine lighting.

The Source of Malaria.*

The investigation on the source of malaria has had the writer's attention for over two years, and in that time a large amount of clinical testimony has been collected from all known malarial districts in North America; the final report, however, will hardly be ready for publication for some months, but from the work already completed certain facts have been obtained which will be embodied in this short notice.

The introduction of artesian wells, first by the railroad companies who desired a larger supply of water than had hitherto been available, and the accidental use of that water by the people in the immediate vicinity, soon produced a marked diminution of malarial trouble in those localities. The artesian supplies were, on the whole, so satisfactory to the railroads that their introduction became very rapid, and in a few years most of the South Atlantic lines depended upon this source of water supply. The evidence that in the exclusive use of the deep-seated waters there was entire immunity from malarial trouble was apparently so incontestable that I determined upon a critical examination of all waters known to produce malaria and those that in malarial districts were proof against it; this examination is not only chemical, but biological and pathological.

In the present state of our knowledge we do not expect to be able to draw a sharp line between waters that produce malaria and those proof against it by purely chemical analysis, nor, on the other hand, can we hope to identify by biological examination the protozoa producing that trouble; but we may by the former succeed in isolating certain toxic products peculiar to those waters only, and by the latter a certain line of testimony that, in conjunction with the chemical investigation, will yield very valuable results. The work thus far has proved satisfactory beyond expectation, and, from the work already done and the character and amount of evidence before me, I am justified in stating that the long current belief that the source of malaria is in the air is in error.

The germ, which is of soil origin, is strictly a protozoa, and reaches its highest development in low, moist ground, with a favorable temperature. Surrounded by the proper soil conditions, this protozoa passes from one stage of life into another with considerable rapidity; so that in the present state of our experimental knowledge it is impossible to identify it, nor is it probable that by culture we shall be able to produce the accepted Laveran germ outside of the human system.

As a rule, the potable water from the malarial districts is derived from driven wells not over twenty-two feet deep, in soil with clay or some other impervious substrata, which water is generally cool and palatable, often sparkling clear, but more frequently a little turbid. This water is filled with an incalculable number of these germs in all stages of development, and if used as a potable water they naturally find their way into the system through the alimentary channel. This protozoa passes through so many forms or stages of life that in some stages it is light enough to float and be transported by the moist air of low grounds, but in this state it is comparatively harmless except under most extraordinary conditions; it is not until the service water is used that the real mischief begins, when, by reason of higher development, it has become much more virulent than that floating in the air. A very short period of incubation is sufficient to develop a severe case of malarial fever in the new-comer who uses the surface water.

From personal observation I know that the exclusive use of pure, deep-seated water affords entire immunity against malaria in sections of country where no white man dared lived using the surface water. Nor must it be understood that the exclusive use of pure water simply fortifies and strengthens the system against the attack of the germ. The water is the primary cause of infection, which acts as the direct carrier of the germ into the system through the intestinal tract.

The impression that malaria is caused by purely atmospheric influences has become so fixed in our minds that, unless we come in actual contact in the evidence produced in the use of pure water as against that heretofore used, the physician will, in all probability, be very slow to allow himself to be convinced that the word malaria (mal, bad; aria, air) is a misnomer, and that malaqua (mal, bad; aqua, water) is the word that should be used to convey the pernicious effects known under the name of malarial fever.

Discharge of the Torpedo Ray.

Some recent researches on this electric fish have been made by Dr. D'Arsonval. He covered the dorsal and ventral areas of a ray with two plates of tin, conductors from which were connected to a 10 volt incandescent lamp. On disturbing the ray by pinching its fins with a dissecting pincers, its discharge was sufficient to produce a momentary illumination of the lamp to a very high intensity.

*Irving H. Bachman, Ph.D., in Medical Bulletin.

THE BEACH HYDRAULIC SHIELD.

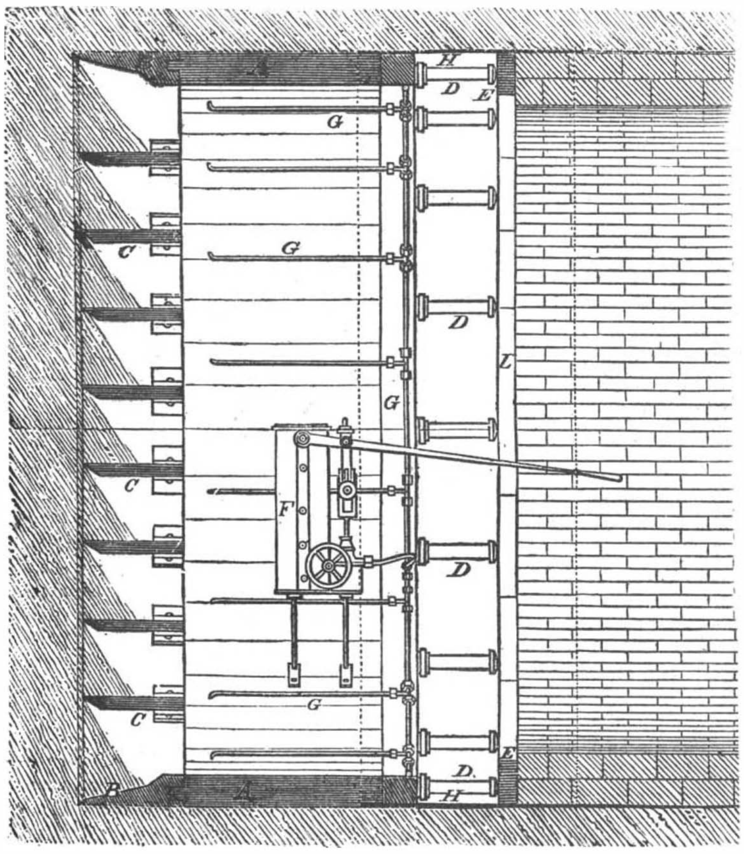
One of the peculiarities in the field of invention is the fact, that has often been mentioned in these columns, of different minds, perhaps in different parts of the world, being engaged at the same time in solving the same problem and arriving simultaneously at the same solution. One of the most peculiar instances of this description is to be found in the case of the Beach shield for tunnel construction. In a recent issue of London Engineer we find the following paragraph :

"In 1869 the Tower subway was constructed by Mr. Peter Barlow and Mr. J. H. Greathead. It is interesting as being the first tunnel in which a shield shoved forward as one structure was used, and for the construction of which cast iron was adopted. The external diameter of the cast iron rings was 7 feet 1¾ inches; the tunnel was driven through the London clay for its whole length, no water had to be dealt with and no difficulties were encountered."

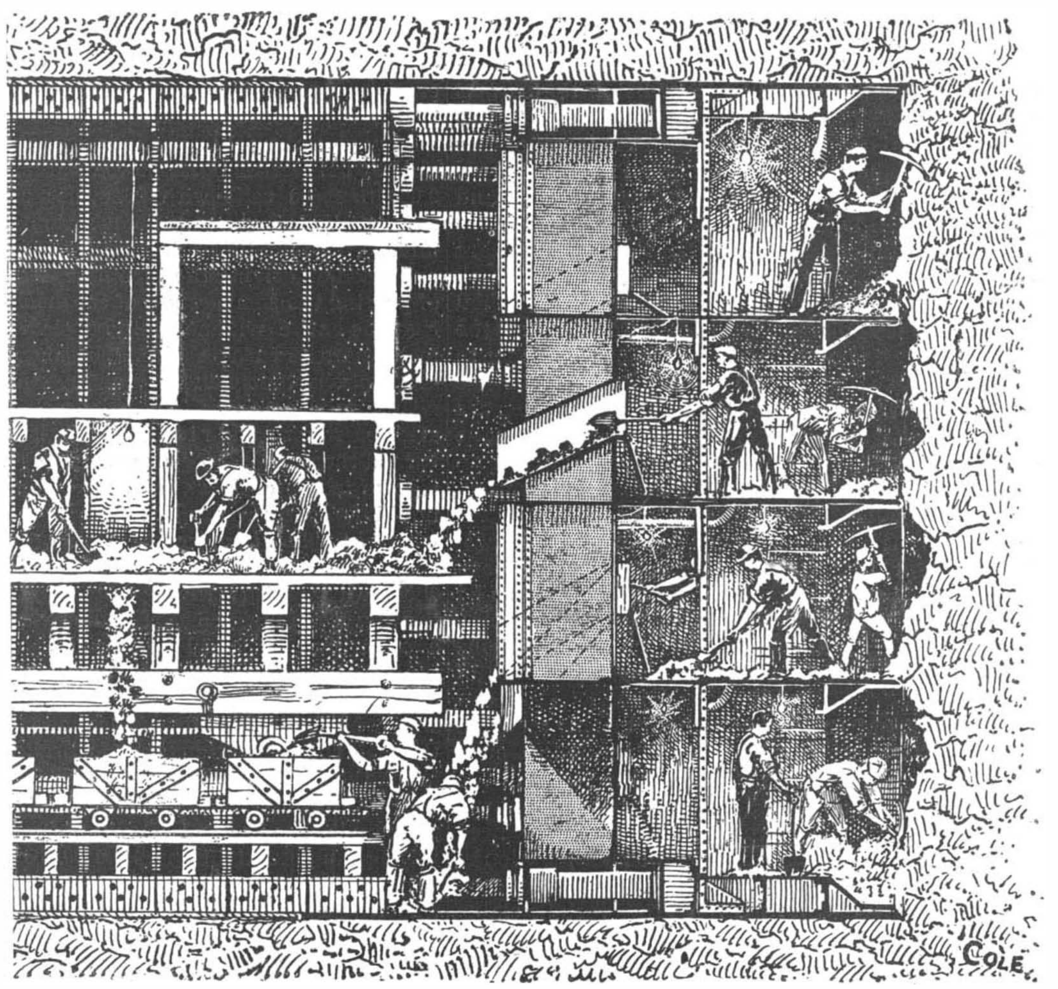
We understand from a perusal of Mr. Barlow's patent that the power employed in the operation of the shield was the jackscrew system. It was also on this line that Mr. Beach's first experiments were made, and when the developments of his ideas as regards the pneumatic system for mail delivery and passenger service had reached an acute stage, it was in this direction that his first experimentation took place. He first conceived of the idea of the shield and the use of screw jacks for propulsive power in 1865, but it was not until 1868 that a model was completed for testing the practicability of his system as applied to actual work.

This experimental device was constructed with the idea of operating the same for excavating the small tunnel for pneumatic postal and parcel delivery, and it was put in operation during the year stated. Its operation seemed to be so satisfactory that Mr. Beach decided to apply for a patent on the device, which was issued on June 8, 1869. It was filed December 29, 1868.

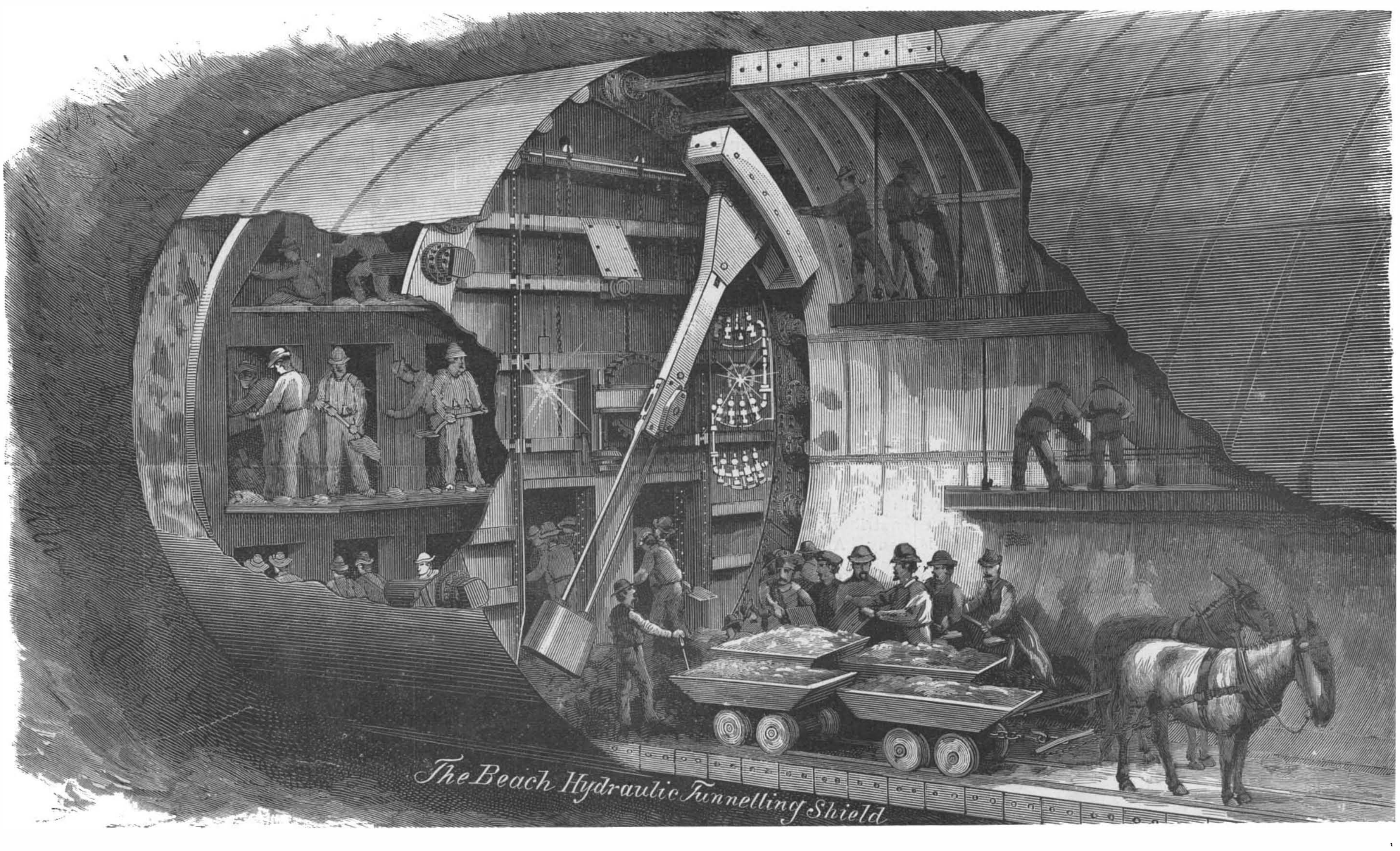
In the meantime the franchise for the construction of an underground railroad under Broadway had been granted by the Legislature of the State of New York, and plans were at once made for the construction of a nine-foot tunnel under that thoroughfare. The necessity for a larger and more efficient system of conducting the work resulted in the construction of a new shield, which was on an advanced and improved system. This measured nine feet two inches in diameter. The use of the antiquated jack screws was abandoned, hydraulic power being substituted as a means for enabling the shield to eat its way into the compact sub-



BEACH SHIELD USED IN THE BROADWAY TUNNEL IN 1869.



HYDRAULIC SHIELD NOW IN USE IN THE BLACKWALL TUNNEL, LONDON.



HYDRAULIC SHIELD USED IN THE ST. CLAIR RIVER TUNNEL.

soil under Broadway. In construction, the shield consisted of a wood cylinder made on the principle of barrel staves clamped endwise between two cast iron rings, the front one being tapered to a cutting edge, while the back one was square shaped. Through this hydraulic rams, arranged equidistant apart around the circle of the shield, protruded, and when forced out by the pump fixed on the side of the shield, rested against the edge of the completed tunnel, an intervening buffer plate, composed of wood sheathed with iron plates, being provided to equally distribute the pressure of the rams. These were all connected by pipes to the pump, and all were pushed backward simultaneously. Separate valves attached to each ram enabled some to be shut off at pleasure; thus by increasing or decreasing the pressure on one side or the other, the shield could be diverted in its course to the right or left or upward or downward, and could be made to adapt itself to any of the conditions of the work, such as going around corners or taking a course nearer the surface of the ground or deeper in the earth, according to the exigencies of the case. The shield, in a word, was under the complete control of a single operator.

Extending rearward from the rear cast iron ring, and overlapping the end of the finished tunnel, was a thin metal hood about three-eighths of an inch thick, for a distance of three feet, in which the new tunnel work was built after the extended ram had been pushed inward.

The conditions surrounding the work were peculiar, because debris removed from the tunnel had all to be carried to the street through the basement and cellar of the building where the operations were begun. It was not possible to interrupt traffic in the street above, and access to the opening was effected through this cellar to the side street adjacent to Broadway. This shield was put in operation in 1869, the same year in which Barlow was engaged in putting his shield in operation in the work of the Tower subway in London. It will be seen that the main feature of this advanced method of tunnel construction was being introduced by different engineers in different continents at the same time without knowledge of each other's work, but the Barlow shield was constructed, it would appear, more on the principle of the early Beach shield of 1868, in which jack screws alone were used as a propulsive power, while the new form of hydraulic shield was a direct step in advance, and was, we believe, the first shield of its kind which was put into practical operation in which the entire shield structure was moved forward by hydraulic power.

The hydraulic shield has since that time remained the vital factor in nearly all great tunnel construction. It is probable that the most conspicuous example of its use is in the Blackwall tunnel under the Thames, in London, in which the largest shield ever used is employed, the external diameter of the tunnel being 27 feet, as against 21 feet, the diameter of the St. Clair tunnel. It is a work of the first magnitude and importance and is now approaching completion. It is under the direction of Chief Engineer Mr. A. R. Binnie. We have reproduced an engraving from the London Engineer which represents a longitudinal section through the shield, showing how the work is now being conducted. We also reproduce a cut taken from the SCIENTIFIC AMERICAN of March 5, 1870, which illustrates the method of operation and construction of the Beach shield. The remarkable similarity between the two is at once apparent, even in features of minute detail, and shows what little necessity there has been for change since the earliest days of this form of construction. By comparing the two structures we find nearly all the main features to be common to both. The cutting edges are of the same form, and the hydraulic jacks are mounted in the same manner, and the divisional platforms also appear, although their function was rather to prevent the sand from falling in mass into the shield than to afford a standing place for the laborers. In the cut, B is the cutting wrought iron rim; A is the wooden framework; D are the hydraulic jacks; C are the retaining shelves, and F represents the pump connection.

In the larger view we represent the shield used in the St. Clair tunnel. It will be seen from an examination of this view that the shield as used there, as well as in the Blackwall tunnel, had a closed head or drum. The necessity for closing the head became evident in carrying on the work under the bed of rivers, and has always, we believe, been adopted under such circumstances. Of course in Mr. Beach's shield under Broadway, no such conditions existing, and no sudden flood of water being expected, the head of the shield was left quite open.

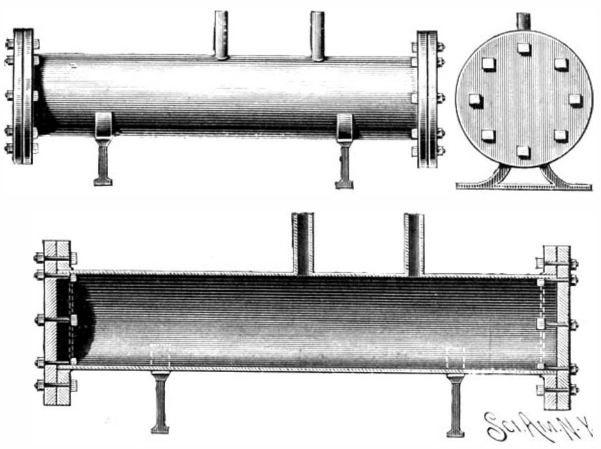
In this cut there also appears another feature not to be found in the early shield—namely, the movable arm for manipulating and putting the sectional plates in position. This is quite an independent construction, and although it is an exceedingly useful adjunct to the efficacy of the work, it can hardly be considered as a component part of the shield proper, as its function is merely auxiliary to the main work to be done by the shield.

To those who may not be familiar with the circumstances surrounding the work under Broadway, it may be of interest to state that it was in pursuance of a well-formed plan to supply the residents of New York with an underground railway, to be operated by forced draught on the pneumatic system. The tunnel was constructed by Mr. Beach alone, at great expense, a distance of more than a city block, but the work finally had to be abandoned owing to the apathy of the general public. The tunnel, however, is still there, and is often visited by the curious.

LABORATORY STILL FOR TAR.

Chemists who have had occasion to distill tar for one purpose or another in organic laboratories with ordinary equipment no doubt have frequently been perplexed as to how to secure a comparatively cheap yet efficient still. Glass retorts will not do as a rule, says the Pharmaceutical Review, to which we are indebted for engraving and particulars, on account of the water contained in the tar and the bumping caused thereby. Good copper retorts of satisfactory size are expensive and ofttimes not readily obtainable. A still of wrought iron pipe, however, can be readily made even in small cities. Such a still has given satisfaction during the past year in the distillation of pine tar, and for the sake of others may deserve description. Students, while working with charges of from 10 to 20 K° of tar, have not met with a single accident.

This particular still was made of a piece of 8 in. wrought iron pipe, 40 in. long, threaded for an inch at each end. Both ends are fitted with cast iron flanges, 14 in. in diameter and ¾ in. thick. Heads of same diameter and thickness are bolted to the flanges by ⅜ in. × 2 in. bolts. Two 1 inch pipes lead out of the top of the still. One is used as exit tube for the distillate, the other as a safety tube. The still rests upon two cast iron legs, its center being 12 inches above the floor. It is heated by a low gas furnace. Large bottles surrounded by cold water are used as condensers.



LABORATORY STILL FOR TAR.

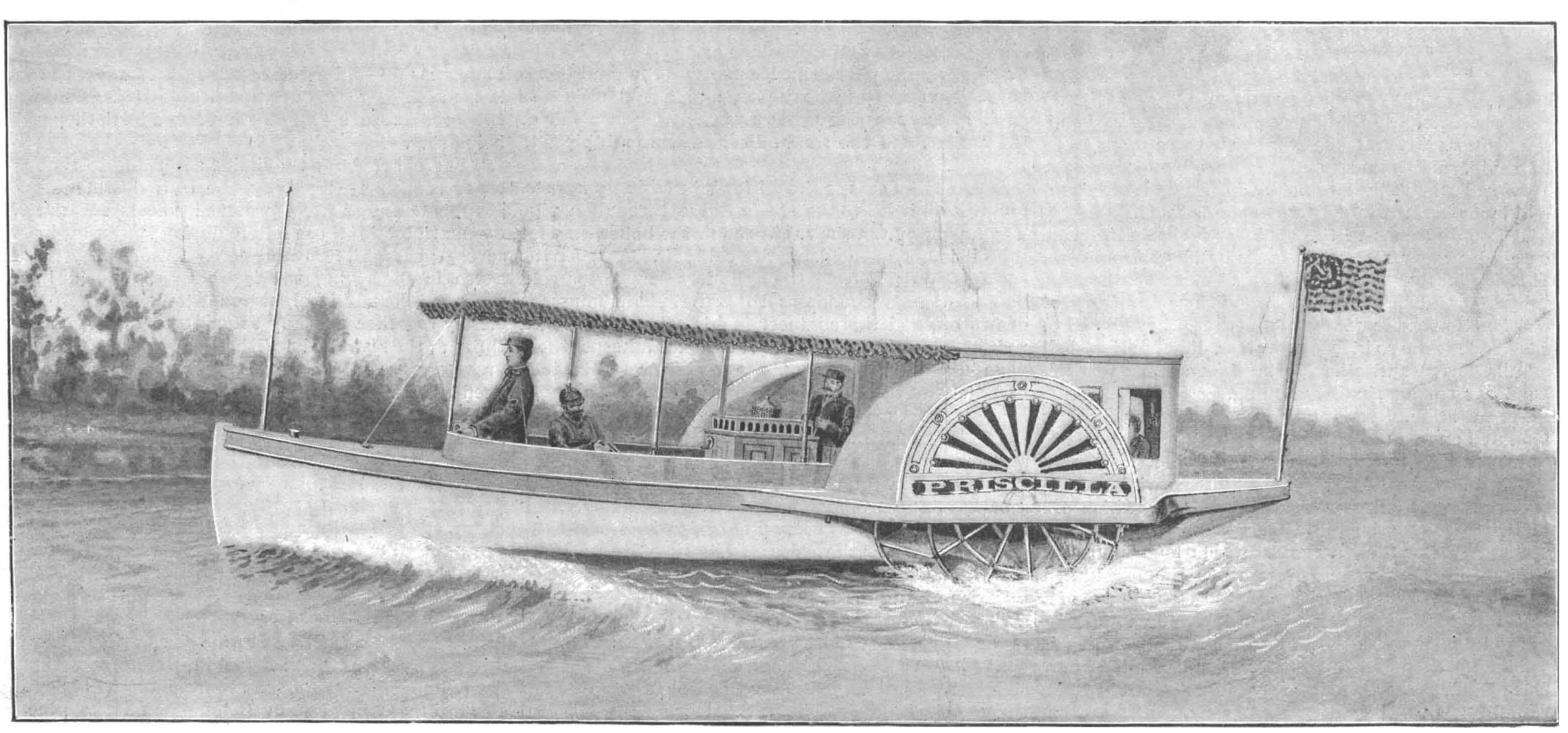
THE DAIMLER SIDE WHEEL LAUNCH PRISCILLA.

In the present issue we illustrate a recent production of the Long Island City factory of the Daimler Motor Company. The side-wheeler Priscilla is a little vessel designed for pleasure navigation, and which will doubtless attract much attention in Florida, whither she is destined to go.

The Priscilla is 30 ft. long and 8 ft. wide, drawing 13 in. of water. Her paddle wheels are 5 ft. in diameter and make 45 revolutions per minute, giving a speed of 8 to 9 miles per hour. The engine which drives her makes 540 revolutions per minute, so that the shaft is geared down from it in a ratio of 12 : 1. It weighs 840 lb. and occupies a central position in the hull.

The Daimler launches have the naphtha tank in the extreme bow, and the pipe for conveying naphtha to the engine runs along the outside of the boat, being partially sunk into the woodwork near the rail. Thence it is carried inward to the engine. Thus a fracture of the pipe, if a collision or similar accident should occur, simply results in letting any naphtha that may escape run off upon the water.

The vessel is of a novel and interesting type. For river work the absence of screws is particularly to be appreciated, on account of their liability to entanglement with floating or subaqueous vegetation—a trouble from which paddle wheels are almost exempt. So small a side-wheeler is in itself a novelty. The motor used in connection with these boats has already been described in these columns and was fully illustrated and shown in SUPPLEMENT, No. 1024.



THE DAIMLER SIDE WHEEL LAUNCH PRISCILLA.

AT the great salt deposits of New Iberia, La., the company described to ascertain the depth of the mass of rock salt, and sank a boring for the purpose. The drill penetrated through 600 feet of solid salt, the cores furnishing the evidence.

Correspondence.

The Bottle That Cannot be Refilled.

To the Editor of the SCIENTIFIC AMERICAN:

Allow me to make some remarks in answer to your article "The Bottle that Cannot be Refilled," in the SCIENTIFIC AMERICAN of November 30, 1895.

First: If people can "imitate both bottles and trademarks of standard makers without detection," then there is no necessity of trying to prevent the refilling of the bottles.

Second: The object (in my opinion) of the fraudulent refillers is not so much for the bottle as for obtaining the label intact.

Millions of bottles are purchased annually from restaurants, etc., the principal object being to get the labels in good order, so that the bottles can be refilled.

Third: As a protection for bottles—to prevent the refilling of them by fraudulent refillers—the labels should be made on the Bank of England's bank note system, including a label destroyer.

ALEX. S. LA FONTAINE.

Cerro Colorado (Amba) Curacoa.

The Integral Parts of a Locomotive.

A writer in the Chicago Record describes the parts of a locomotive and their functions and the feeling an engineer has for the one he drives.

Down grade, a clear track, an easy siding seven miles ahead, No. 2 out of the way, seventy pounds of air, twenty empties and a caboose behind, the fireman on the footboard polishing the hand rail and throwing rapid transit kisses to the pretty girl on the fence; a fresh pipeful of tobacco, a bright, crisp morning, steam shut off, the locomotive sliding down the slant with only the noise of rumbling machinery and the rush of sixty-five tons of metal and breakfast but half an hour off, are conditions which fill the heart of the engineer in the cab with a rapturous love of life and movement. Like an enormous toboggan the freight train glides down the incline, swaying and creaking, jolting and jumping on the curves, but not a puff or hiss from the engine. Then comes the drone of the whistle, the grinding of the brake shoes on the wheels as the air is put on, three or four impatient yaps from the locomotive, a switch is thrown, and the magnificent machine draws ahead slowly and with dignity onto the siding.

It was an old engineer who said, patting the great driving wheel: "Electric motors may take the place of steam locomotives some day, but they never will be as handsome."

He spoke from his heart, for to the engineer and fireman a locomotive is the greatest, the most magnificent, the finest, the most intelligent, and nearest approach to a human being in the mechanical world. The engineer speaks of his engine as "her." He encourages her, and chides her, and sometimes swears at her when she is "cranky."

He protects her from stiff joints with the finest of lubricating oil; she is fed with the best of coal, and bedecked with the brilliantly polished brass and copper fittings. He watches over her with a jealous guardianship, and humors and caresses her constantly. He is sad when she does not reciprocate his affection, and lauds her unstintedly when she is good.

This enthusiasm of the engineer is shared to some extent by every man who stands beside a locomotive. It is fascinating to the average admirer, because it is mysterious. The beautiful proportions and massive construction excite admiration because they appeal to the eye, but the rods, pipes, valves, link motion, bell cranks, levers, and other parts of its anatomy are beyond the common understanding.

Yet a locomotive is but two stationary engines mounted on wheels, which also carry the boiler, fire box, pump, and attendants. If anything, it is more simple in construction than some of the triple expansion or compound Corliss valve engines which are bolted to foundations in a machine shop or a great factory. There are thousands of stationary engines equipped with reversing gears almost identical with those used on a locomotive, and the steam valve of a locomotive is a simple sliding valve.

The locomotive consists, first, of its boiler, which is solidly attached to the two steam cylinders in front. The cylinders are bolted firmly to the frame of the running gear. The back part of the boiler stands between and over the driving wheels, and over it is the cab, which protects the engineer and fireman from the weather.

The furnace, or fire box, is part of the boiler, in that it is not a separate and outside furnace, and the sides of the furnace are formed by the water legs of the boiler, which come down to below the grate bars. This gives the rear end of the boiler a shape like a keyhole.

The hump or dome on top of the boiler nearest the engine cab is the steam dome, and from this dome the dry steam is taken to the steam cylinders through a pipe which passes through the boiler and divides into two pipes under the smokestack. That part of the boiler which begins under the smokestack and extends to the pilot or "cowcatcher" is called the "smoke box," and in it is a wire netting which catches the sparks and cinders.

The "exhaust" steam from the cylinders passes up through an exhaust pipe which does not quite reach the bottom of the stack inside of the smokebox, so that the steam, forced out of the exhaust in puffs, makes a draught which sucks the air through the grate bars in the bottom of the firebox to perfect combustion.

In the dome end of the steam pipe which conveys the steam from the dome to the cylinders is a valve, which is opened and closed by a rod that passes back to the engine cab. This is the "throttle valve," and when the engineer says he has "thrown her wide open," he means that he has pulled back the "starting bar" so far that the valve in the dome is opened as far as it will go, and the cylinders are getting all of the steam that it is possible to give them. The engineer keeps his hand on the lever of the starting bar, or, as it is commonly called, the "throttle." The lever which comes up, almost touching his knee, is the reversing lever. It is similar in design, but much more finished in workmanship and of handsomer proportions, to the grip lever in a cable car.

At its lower end it is held by a steel pin to the frame and moves back and forth. An arched piece of flat steel with notches cut in the upper edge, called the "sector," is used to hold the reversing lever in any position desired, for a steel tongue, raised and lowered by a lever which extends down the handle of the reversing lever, fits into the notches and thus holds the reversing lever. The reversing lever moves the "reach" far back and forth, and the reach bar is connected with the link motion.

The link motion is a device by which the engineer can let steam in at either end of the cylinder, and thus start his engine ahead or reverse it. This is done by two eccentric rods, the "forward" and "backward," which by suitable mechanism that must be seen to be understood actuate the sliding valve in the steam chest.

By throwing the reversing lever forward the valve gear is so adjusted that the steam enters the cylinder so as to move the engine forward; by throwing the reversing lever back the opposite effect is secured.

A locomotive moves over the steel rails because of its "tractive" force. This traction is increased by increasing the weight over the driving wheels. The friction between the tires of the drivers and the steel rails causes the wheels to grip the metal, and as the rails are immovable, the wheels must go forward.

The steam, by pressure and expansion, forces the piston in the cylinder to move. The "piston rod" is connected with the "crosshead," which moves back and forth between the "guide bars." The connecting rod transmits the motion to the drivers, and the drivers, revolving, move the engine.

It is sometimes necessary to increase the friction between the drivers and rails, and this is done by throwing dry sand on the rails immediately in front of the driving wheels. On some locomotives the sand box is perched on top of the boiler, and a rod from the engine cab opens the sand valves, one for each side of the engine, and the sand falls down through pipes to the rails.

Steam cylinders require oil for lubricating purposes, and this oil is fed to the steam valve through a pipe which passes from the cab through the boiler, so that the oil is not affected by the cold air. As soon as steam is shut off from the cylinders they grow cold and the steam condenses to water. This must be drawn off, and the engineer in his cab, by pulling a rod, opens the "cylinder cocks" and keeps them open until the sound of the escaping steam tells him that nothing but dry steam is passing through. It is when the cylinder cocks are open that the flying locomotive sends out jets of steam to the right and left.

In the tender of the locomotive, which is entirely separate from, although a part of, the locomotive, the coal and water are stored. The water is kept in the tank which forms the sides and back of the tender, and the water, brought from the tank through a feed pipe, is forced into the boiler through an injector.

The fireman, with a large scoop shovel, feeds the ravenous maw of the locomotive with coal. A chain is hooked to the furnace door, and when the fireman slides a scoopful of coal over the iron floor plates to the door he pulls the chain, the door opens, the coal is dumped into the firebox, and the door is slammed shut at once, for no fireman likes to let cold air enter his firebox over the fire.

The careful fireman does his work on the principle that slow combustion is the nearest to perfection, because it makes less clinkers and saves fuel and labor in cleaning. He keeps his fire bright and has no "cold" corners, and keeps his fire even so far as thickness of burning coal is concerned.

It is his duty to keep steam up and the boiler supplied with water, help the engineer to look out for signals, oil up, keep the cab clean, ring the bell, and throw coal at tramps who may be stealing a ride on the front platform of the mail car.

The invention of the automatic air brake relieved the engineer of a great deal of worry and nerve tension, for by a slight movement of the handle of the "engineer's" valve he can apply the brakes on every car of a train equipped with automatic air brakes.

In a short time the old familiar whistle "down brakes," which sends a train crew galloping over the tops of freight cars to wind up the hand brakes, will be heard no more, for every railroad in the country is equipping its freight cars with automatic air brakes, thus giving the engineer as much control over a hog train as he has over the "fast mails" and "limited throughs."

Standing in a vertical position on one side of a locomotive is the air pump. It compresses air into a main reservoir tank, which generally is placed under the front end of the boiler. From this line a pipe leads to the engineer's valve in the cab, and from this valve the air is admitted to the main air pipe, which extends under the train. The air in this pipe is kept at a pressure of about seventy pounds to the square inch.

Before the train leaves the station the auxiliary air reservoirs under each car are filled with compressed air, and this air is passed into the brake cylinders whenever, from any cause whatsoever, the pressure in the main air or train pipe is decreased. The engineer sets the brake by letting some air out of the train pipe.

If he is approaching a station he lowers the pressure gradually, thus applying the brakes by degrees, but if he sees the headlight of another locomotive coming toward him on the same track, he applies the emergency stop by opening the valve slide, and this sets the brake so "quick and hard" that the passengers are "brought up standing."

In the engine cab are steam gages and air gages, gage cocks for ascertaining the level of the water in the boiler, a water glass for the same purpose, levers for opening the safety valve, a cord for ringing the bell, a clock, and generally a number of photographs of pretty women, while under the cushions in a box are tools of all kinds and descriptions, the always present lunch box, and the soap and towels which the fireman and engineer use when they wash up after a run.

An Antarctic Continent.

The Hydrographic Office has received corroborative reports from mariners which go far to demonstrate the existence of an antarctic continent of considerable extent and elevation. The Naval Hydrographer, in connection with a recent ice chart issue, gives a few of the most important reports from a navigator's point of view, and says:

"On no other frequented trade route are vessels so liable to be obstructed by drift ice as in that portion of the South Atlantic lying to the east of Cape Horn and the Falkland Islands. As given by the most reliable authorities, the mean ice limit for this region runs northeastward from Cape Horn through latitude 50 degrees south, longitude 52 degrees west, as far as latitude 42 degrees south, longitude 35 degrees west, the occurrence of ice north of the fortieth parallel being rare.

"The chart shows the limits, according to the numerous reports received by the United States Hydrographic Office, of the enormous ice fields encountered by mariners in those waters during the exceptionally severe years of 1892 and 1893. All of these reports agree in describing the icebergs seen during these years as colossal in height and extent, and herded so closely together that any attempt to force a passage through the main body of the drift was attended by grave danger, many vessels being more or less damaged by collision, and two lost.

"A remarkable feature of the ice seen during these years was the different age of neighboring bergs, many of them presenting the sharp outline, jagged edge, and perpendicular face of recently detached ice, while others showed evidence of having been long afloat. Earth stains and discolorations upon several showed that at some period they had been in contact with the land."

Tree Ages.

Gericke, the great German forester, writes that the greatest ages to which trees in Germany are positively known to have lived are from 500 to 570 years. For instance, the pine in Bohemia and the pine in Norway and Sweden have lived to the latter age. Next comes the silver fir, which in the Bohemian forests has stood and thrived for upward of 400 years. In Bavaria the larch has reached the age of 275 years. Of foliage trees, the oak appears to have survived the longest. The best example is the evergreen oak at Aschoffenburg, which reached the age of 410 years. Other oaks in Germany have lived to be from 315 to 320 years old. At Aschoffenburg the red beech has lived to the age of 245 years, and at other points to the age of 225 years. Of other trees, the highest known are ash 170 years, birch 160 to 200 years, aspen 220 years, mountain maple 225 years, elm 130 years, and red alder 145 years.—Public Opinion.

A Carbonic Acid Spring.

While boring operations were going on at Sondra, near Gotha, the diamond drill was suddenly thrown up on July 27, when a depth of 627 ft. had been reached, and water and gas rushed up under a tremendous pressure. For 24 hours nothing could be done. The eruption of carbonic acid gas then quieted down sufficiently to allow operations to be restarted, but 20 ft. lower down gas was again struck, and this time the men had to flee for their lives. The roar was so terrible that the people around become seriously alarmed. It is estimated that hundreds of thousands of cubic yards of carbonic dioxide were discharged every hour, and that the original pressures of the gas amounted to 400 lb. or 500 lb. Heavy iron tools were tossed about like playing balls. Mr. Max Landgraf, the superintending engineer, was telegraphed for. For some time, however, nothing could be done but to rail in the place and wait for calmer days. At intervals of an hour and a half or two hours mineral water was thrown up 100 ft. This water resembled in its composition the water of the famous steel spring of Liebenstein, a favorite health resort of the Thuringian Forest, only a few miles from Sondra. This is the third time that powerful sources of carbonic acid have been met with in Germany in recent days. The acid spring near Münden, in Hanover, has been active for some time; the one at Salzungen was struck last March. During October the Sondra spring was successfully tapped, not without difficulty. The apparatus consists of a system of pipes screwed into one another, cocks for the water and the gas, and a manometer. It was supplied by Messrs. Biegleb, Hansen & Company, of Gotha, and took two days to fix; several times the whole apparatus was blown out again. The gas consists of very pure carbonic acid, 98 per cent, with 2 per cent of nitrogen. It rushes out at a temperature of about 40° Fah., and is now being secured—at least a small portion of it. The water, which contains sulphur besides the free carbonic acid, is as much appreciated as the Liebenstein spring. The first primitive attempts to secure the mineral water in ordinary bottles failed, the bottles being burst. The boring was undertaken by a Cologne company with the hope of finding potassium salts. This idea has not been given up, but for the present the carbonic acid claims attention, and the search for potassium salts will be continued in another place. The simultaneous outbreak of both would be undesirable.—Engineering.

Spots on Prints.

Referring to spots appearing on photographic prints, the British Journal of Photography says: "They are produced from a cause but little suspected by many, namely, from dust of a pernicious nature settling on the prints while they are in a moist state. The dust from coke stoves seems, from some experiments we made some years ago, to be of a highly injurious nature; and there is generally plenty of that about, where coke is burnt, when the stoves are disturbed and the atmosphere is dry. Sometimes these spots make their appearance before the prints are mounted, but, more generally, not till some time afterward. As a rule, there is no visible nucleus, as that, of course, comes away when the paper is dry, but not before the mischief has been done, although it may be at once manifest. Particles of coke dust are not the only ones that will cause these spots, for several of the things used in the dark room will do the same—bichloride of mercury, for example. A little of its solution spilt on the floor, and allowed to dry, becomes dust when the room is next swept out. If moist prints were always carefully protected from dust and floating particles, we should hear far less of mysterious spots on prints."

SPAIN produces annually 80,000,000 gallons of olive oil, Italy 35,000,000 gallons, and France about 30,000,000 gallons.

THE LEAMY REVOLVING TRAPEZE.

The application of mechanics to scenic and gymnastic displays has an interesting exponent in the revolving trapeze, an exhibition which, after attracting much attention in England, has come back to the United States, and is now being shown in the native country of its inventor. It forms one of the principal attractions of the Olympia Music Hall in this city. In the smaller cut we illustrate the mechanism

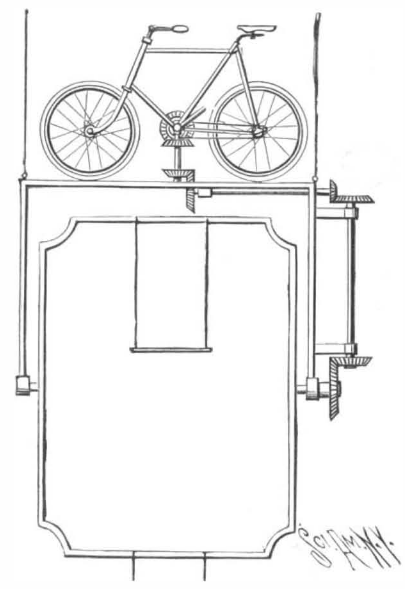
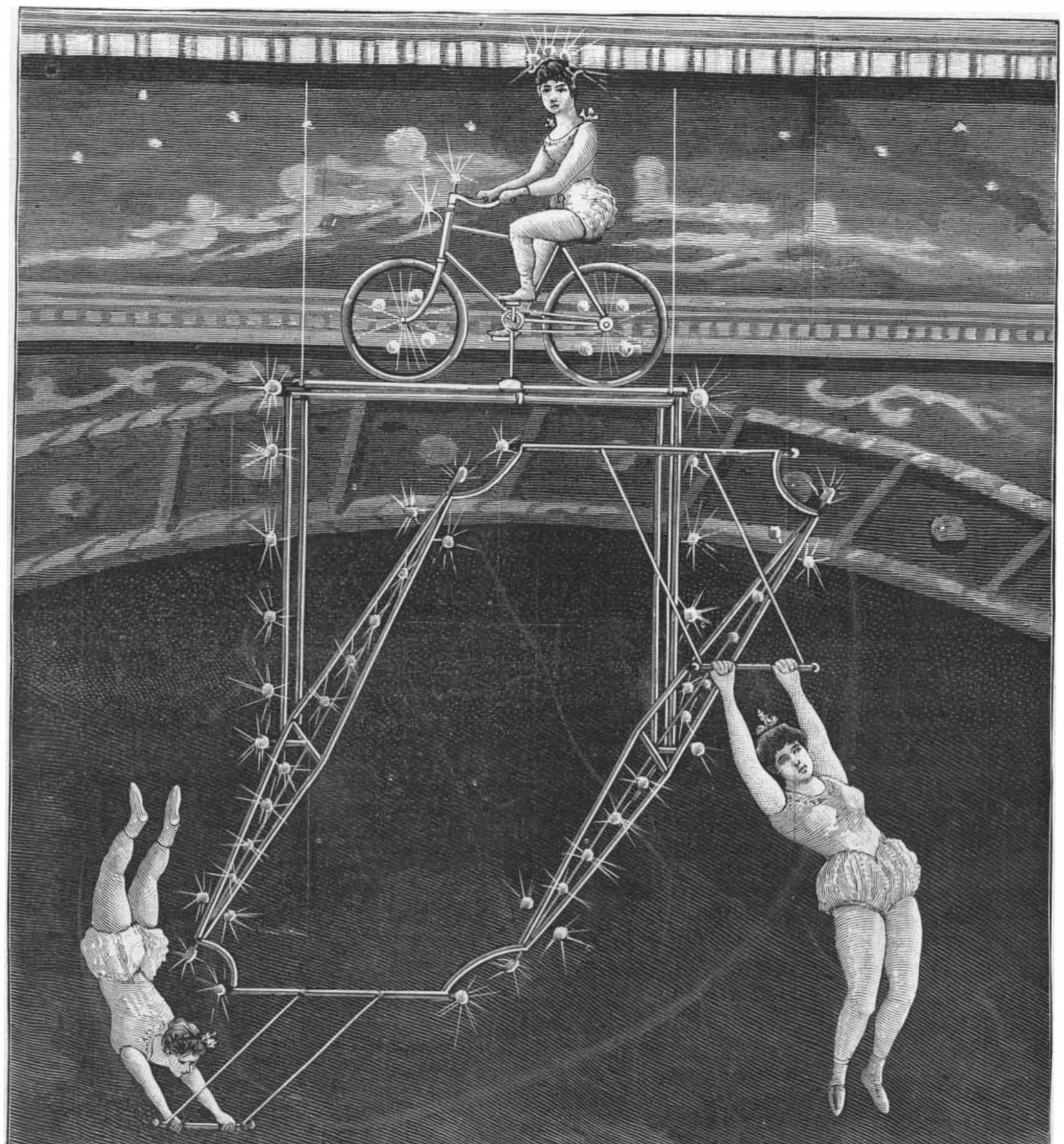


DIAGRAM OF THE REVOLVING TRAPEZE.

of the apparatus, while the performance executed upon the apparatus is shown in the larger cut. From the ceiling of the great auditorium is suspended a vertical three sided rectangular frame open at the bottom. In its lower extremity is journaled at the center a four sided rectangular frame, from whose extremities two trapezes hang. To the upper side of the vertical frame is secured a bicycle, which by gearing shown in the small cut connects with the axle of the lower frame, so that when the cranks of the bicycle are worked the lower frame is turned round and round. It can be brought into accurate balance by means of shot. The whole apparatus, including the bicycle, is studded with incandescent electric lamps, and the performer who rides the bicycle wears a helmet carrying electric lights. The very striking performance is explained in great measure by the cut.



THE LEAMY REVOLVING TRAPEZE AT THE OLYMPIA MUSIC HALL.

One of the performers sits on the bicycle and, turning the cranks, as if riding, keeps the lower frame in rotation, while two performers perform different evolutions on the trapezes thus carried around through the air. A switch board is placed at the head of the bicycle, and by manipulating switches the vari-colored electric lights are turned on and off so as to produce any desired effect. Independent of the high merit of the performance simply as gymnastics, the mechanical points are of value; for ease and safety of manipulation and security from any failure is an absolute essential. No one has anything to do with its operation except the three performers, so that it is constantly under their control. Where any attempt is made to operate such mechanism from behind the scenes, there is always a great liability of trouble or partial failure, but here the performer on the bicycle does all the work of actuating the mechanical portion and has every part under constant supervision and control, while the illuminated bicycle, located as it is at great height from the floor, is an added attraction. It is not too much to say that this exhibit is one of the star pieces of the entire performance. The length of the trapeze ropes, it will be observed, is so adjusted as to allow the performer to pass through the frame without touching it, and the absence of a center bar in the frame is necessary to the same end.

An Earthquake in Persia.

On November 17, 1893, a most destructive earthquake occurred at Kuchan, Persia. The city was practically destroyed, and the loss of life was enormous, it being reported that twelve thousand persons perished.

A cable dispatch from Teheran, Persia, dated January 9, states that two severe earthquakes, causing the loss of 1,100 lives, have occurred in the Khalkhal district.

The first shock, which was experienced on January 2, was very severe. It completely destroyed the village of Zanzabad and partly destroyed other villages. Three hundred persons perished in the several villages.

On the following Sunday there was another and severe shock which destroyed the small town of Goi and did great damage in many of the villages in the district affected. Eight hundred persons were killed in Goi alone. Large numbers of cattle and sheep perished.

The London Times of January 10 published a dispatch from Teheran saying it is reported in that city that severe earthquakes were felt on January 8 at Meshed and Kelat.

No damage was done at the former place. What, if any, damage was done at Kelat is not known at present.

The Swiss National Exhibition.

The Swiss National Exposition will be held at Geneva, beginning May 1 and ending October 15, 1896. The Swiss Confederation has made liberal appropriations and the different cities and cantons have contributed largely to a popular subscription. The exhibition grounds are on both banks of the river Arve, and the directors of the enterprise have erected some fine buildings, which are now rapidly approaching completion, and great attention has been paid to landscape gardening. There are many unique features in the mechanical and the electrical departments. The electric exhibit will be one of the most important collections of electrical appliances ever seen in Europe. Twelve thousand horse power will be derived from the River Rhone and will be transmitted to the exhibition grounds from a long distance. An interesting feature of the exposition will be the electric carriages which will convey the visitors to the part of the grounds which they wish to visit. The exposition promises to represent all that is best in industry and science in Switzerland.

RECENTLY PATENTED INVENTIONS.

Engineering.

ROTARY ENGINE.—Oscar E. Morse, Dillon, Montana. A piston carrier in which are transversely reciprocating pistons is mounted in the steam cylinder of this engine, the reciprocation of the pistons being caused by fixed eccentrics and eccentric plates during the rotary motion of the carrier. The pistons are rotated equally well in either direction, the steam acting on them at all times at a certain distance from their axes, producing a steady and even motion, and an automatic governor admits more or less steam as the speed increases or decreases.

Railway Appliances.

CAR FENDER.—Mariano Sparmo, New York City. This fender is so constructed that an object falling on its bed causes the front end to rise and prevent the object from rolling off, side and guard rails also cooperating to this end, and there being at the front of the dashboard a buffer to prevent injury to persons caught on the fender. A rock shaft operates a forward pivoted fender section and spring-controlled slides operate the rock shaft when a body falls on the bed, latches engaging the slides. The fender may be applied to any car without interfering with its brake or motor mechanism, and when not in use the fender may be slid beneath the car out of the way.

PLATFORM DUMPING CAR.—Scott Webber, Pigeon Cove, Mass. This car is especially designed for dumping heavy material, as stone blocks, a suitable distance from the side of the track, and the car has two trucks, a drawbar having swivel connection with each of the trucks. A rocker bed on each of the trucks is engaged by rockers on the platform, blocks being normally engaged between the rockers and their beds at each side, and mechanism being provided for moving the blocks of each side. On the drawbar are rubbing plates engaging opposite sides of the rockers and rocker beds to prevent displacement.

AIR BRAKE DEVICE.—Earl B. Stoner, Seaside, Oregon. This is an attachment for angle cocks, comprising a box or casing inclosing an automatic valve-like device. It is an automatic check valve attachment for the train pipe of a Westinghouse air brake system, permitting the passage of air around the angle or stopcock of the pipe when closed, so that the engineer is able to retain control of the system, even if the angle cock be carelessly or maliciously manipulated, thus preventing air from being shut off from the car so long as the hose is duly connected or coupled.

BERTH STEP.—Alfred E. Crow, New York. This inventor provides a simple device for use in reaching the upper berths of sleeping cars and vessels, consisting of a swinging frame, adapted when not in use to close into a recess of a berth rail, and so be entirely out of the way. A series of folding steps fold into the rail with the frame, the steps dropping automatically into position when the frame is swung open, and the steps being so connected with the frame that when the latter is swung up the steps will be automatically folded to enter the recess in the rail.

STATION INDICATOR.—Gustav Tresenreuter, Berlin, Germany. This is a device for use on the cars of street railways to indicate different points or crossings along the line. The indicator, carrying an endless band on which are marked the different stations, in a suitable casing, is driven by the movement of the car wheels, and means are provided, should the wheels slip on the track, for conveniently readjusting the mechanism. The device is very simple and inexpensive, and may be ordinarily operated without requiring any attention from the conductor.

MAIL CRANE.—Erastus L. Peirce, Topeka, Kansas. Upon an upright post at the side of the track are two pivoted arms, between which the top and bottom of the mail sack is removably secured, the upper arm having a straight extension beyond the pivotal point and the lower arm a cranked extension, and these extensions being connected by a rod. When the arms are swung down they take up but little room, and the mail bag may be conveniently secured to them and the arms swung up, without requiring a platform for the mail carrier to stand on while adjusting the pouch.

Electrical.

AUTOMATIC ALARM.—George B. Williams, Texarkana, Texas. This is a device, more especially adapted for employment in connection with dry pipe sprinkler systems for protection against fire, the alarm giving warning when the air pressure in the pipes falls below a certain point. The alarm indicates first the fall of the air pressure, and afterward gives warning when the water has entered the pipes of the system. Different forms of contact valve are provided, and different arrangements of circuit-closing devices, for more or less complicated systems.

Mining, Etc.

EXTRACTING METALS FROM THEIR ORES.—Henry G. Williams, Pueblo, Col. This inventor provides a method of and apparatus for the extraction of metals by the chlorination or wet process, the ore having the usual preliminary preparation, such as pulverizing, roasting, etc. The method consists in simultaneously introducing the precipitating agent and an independent agitating blast of steam into the solution of metal, to secure admixture and agitation by a whirling motion and the agglomeration of the precipitated particles of metal, continuously separating the precipitate by settlement and filtration.

Mechanical.

COMBINATION TOOL.—Oscar E. Morse and Everett H. Brundage, Dillon, Montana. This is a combined hatchet, hammer, and nail puller. In the head of the tool is a recess into which the nail-pulling device may be withdrawn, and locked in withdrawn position. Its shank extends up a tubular opening in the handle, where a dog pivoted in a lateral recess is adapted to engage a screw in the end of the shank, locking it so it cannot rattle.

SAW SET.—Fred W. Brown, Wolcott, N. Y. This device comprises a base to which is pivoted a movable clamping arm adapted to engage the saw, the base having an anvil surface with swaging recesses in front of the end of the clamping arm. The anvil has recesses of different depths, whereby the saw teeth may be set to a greater or less extent, and the whole device is very simple and inexpensive.

MACHINE GUARD.—George F. Fisher, North Tonawanda, N. Y. This invention relates to woodworking machines, such as hand joiners, variety moulders, shapers, etc., providing therefor a guard to prevent accidents to the attendants. A hood or guard, made in sections arranged to telescope horizontally and longitudinally, is held above the cutter and transversely of the table, to expose more or less of the cutter and of the work as may be necessary at one time. The hood yields readily to permit placing the work, and may be swung to one side to give access for repairs and other purposes.

DRILL SHARPENER.—Ole Larson and John W. Carlson, Wardner, Idaho. A simple and easily adjusted and operated machine by which to sharpen "Burleigh" or grooved drills is provided by these inventors. The drill holder is movable along a framing and is held in suitable position by a lever and detent, and there is an opening in a drill guide for the passage of the drill, holding pieces being movable toward and from such opening. A handle lever is connected with an armed wheel engaging movable sharpening bits to move the latter as desired.

LEATHER WORKING MACHINE.—Robert Steyer, Dohna, Germany. For stretching, finishing and dressing leather, this inventor provides a machine consisting essentially of a frame adapted to carry and regularly move the hide or side, in connection with a revoluble shaft carrying a series of stretching and finishing tools yieldingly engaging the leather to finish and stretch it.

BOX MACHINE.—Otis A. Sanford, Newcastle, Cal. To make wooden boxes rapidly and automatically, this machine comprises a mechanism to support and move the end boards, and to place and nail one side board thereon, turning the end boards with the side board through an angle of ninety degrees, then placing and nailing in position a bottom board, again turning the box to bring the unfinished side uppermost, and finally placing and nailing the second sideboard and discharging the box from the machine, the several mechanisms being operated by common power.

MANUFACTURING WIRE BALE TIES.—Albert Henley, Lawrence, Kansas. To form ties of uniform length without waste of material, and without undue strain or wear on the parts of the machine, this invention provides for a traveling head with a revoluble spindle for forming the twist in the end of the wire, a pair of gripping jaws holding the wire in place during the twisting of the loop by the spindle. The wire to be formed into ties unwinds from a spool, and passes through a wire-straightening device of any approved construction to one of the heads of the machine.

Agricultural.

POTATO CUTTER.—Albert J. Wood, Wilder, Kansas. For cutting potatoes for seeding purposes, or for slicing or cutting vegetables, the potatoes or other vegetables are fed by a vertical plunger to the knives, being automatically centered by a cradle or hopper, yet being capable of yielding to the plunger, so as not to be unnecessarily bruised. The knife frame, with a series of knives, is removably placed in a supporting frame, a crossing knife being located below the frame knives, while the hopper over all the knives has spring-controlled gate members, fingers entering the spaces between the frame knives, between which also the plunger reciprocates within the hopper.

HEEL SWEEP BRACE.—Augustus C. Ferrell and Thomas J. Hamrick, Carroll, Texas. This improvement comprises a brace for heel sweeps of strong and inexpensive construction, by which the wings of the sweep will be prevented from closing, and that portion of the sweep through which the heel bolt passes will be materially strengthened. The brace comprises three bars of completely adjustable character, the device being applicable to all kinds and sizes of sweeps.

CREAM SEPARATOR DISKS.—William J. Bush, Battle Creek, Neb. A holder for use in cleaning these disks is provided by this improvement, the holder supporting the disks so they may be subjected to the action of a jet of steam and turned so that every part of the disks will be effectually cleaned. The disks are thoroughly heated to loosen the dirt, which is thrown off by the centrifugal motion as they are rotated by the steam, the heated disks drying immediately when the steam is shut off.

Miscellaneous.

CYCLOMETER.—Fred M. Carroll, Union City, Pa. This is an instrument to be attached to any vehicle for registering the aggregate number of miles traveled during a specified time, and having also an independent registering device to show the distance traveled each day, the auxiliary register being independent of the other, though operated by the same mechanism. In a suitable casing a series of recording disks are loosely mounted on a spindle, there being a worm and worm wheel from which the disk spindle is extended for actuating the disks from the wheel of the vehicle, while a pointer mounted on the spindle travels over a dial, and registering wheels independent of the disks are operated by the pointer.

TYPEWRITING MACHINE.—Horace G. Perry, Suisun City, Cal. In this machine are sets of typebars with single characters and sets with duplex or multiple characters, adapted to print short words or syllables, as "an," "as," "is," etc., there being an escapement device to feed the carriage different distances corresponding to the space occupied by the characters on the different type bars. The improvement is designed to afford a machine of simple and inexpensive character which shall have certain important advantages over other machines, and which may be operated with rapidity and nicety.

EXTENSION JOINT FOR BRICKWORK.—Seymour G. Smith, Plainfield, N. J. This improvement is especially applicable in the construction of furnaces, retorts, chimneys, etc., and all brickwork subjected to heat. It consists of placing transversely in the wall a sheet of asbestos or other non-combustible material, the sheet being interwoven with the brick as the different courses are laid, so that joints are broken upwardly and in depth, the sheets thus forming a zigzag line both vertically and transversely, and their side edges being flush with the faces of the wall. They are preferably placed about three feet apart in a wall, thus rendering the wall sufficiently elastic to compensate for the expansion of adjacent sections.

HINGE.—Edwin F. Tilley, New York City. This is an improvement in hinges not permanently connected by the usual pintle, but so constructed that they may be mounted on each other and yet be easily separated. The hinge consists of two sections, one formed with an opening extending through it and having closed sides, one side of the opening being beveled, while the other section has a tongue which fits within the opening, and has its side adjacent to the beveled side of the opening also beveled to conform to the opening side. The improvement is especially adapted to folding couches and beds, tool chests, etc.

PICTURE EXHIBITOR.—George W. Brown, Colorado Springs, Col. This is an improvement in devices adapted for advertising purposes, and comprises a revolving and endwise movable drum in a casing provided with a sight aperture, there being means for rotating the drum and moving it endwise, while the drum, when it reaches the end of its movement, stops automatically and returns to its original position. On the surface of the drum is a spiral strip on which may be arranged pictures or printed matter.

CONVERTIBLE BED AND FIRE ESCAPE.—Henry Marcheter, Wallaceburg, Canada. When in folded condition, this improvement affords a simple, all-metallic spring bed, forming an elastic bed bottom when in position on a bedstead, but it may be readily extended through a window to hang pendent as a ladder. The improvement comprises a number of bed sections, each consisting of two metal strips to the ends of which are secured U-shaped springs, link bars uniting the ends of the sections, and the springs being adapted to form steps when the sections are unfolded.

MOP.—Eugene Stebinger, Portland, Oregon. This improvement consists of a handled roller frame carrying a roller, there being pivoted thereon a second frame carrying a roller, the mop fabric passing between the rollers, while a mop head carrying the fabric slides on guides held on the frame. The construction provides for quickly and conveniently wringing the mop fabric without using the hands directly in such work, facilitating the use of hot water, lyes, etc., in cleaning floors, without detriment to the hands.

CUFF BUTTON.—William G. Sutton, Winston, N. C. This is a button with a clamping device adapted to engage the coat sleeve, holding the cuff always in the same position relative to the sleeve without exposing part of the clamping device or hiding the head of the button. There are serrations on the under side of the head at one side and a spring is extended from the shank to an engagement with the head.

FOOT BRUSH.—Peter Morck, Chicago, Ill. This is an improvement in brushes adapted to engage the sole of the shoe, to subject it to a scraping and a brushing action. The invention provides for stationary side brushes and a vertically movable bottom brush, the latter being made up of sections between which are stationary scrapers so arranged that when the brushes are depressed the foot will rest on the scrapers. Two brush sections are preferably placed side by side, each adapted to receive one foot.

RATTLE.—George C. Smith, Fishkill-on-the-Hudson, N. Y. This is a toy consisting of a rubber body with elastic rings at its ends, one being a teething ring, while the other ring embraces a rattle consisting of a casing having inclosed balls and an exterior groove. The device is very simple and inexpensive.

CHOCOLATE DIPPER.—Cyprien Gousset, New York City. This is one of several successive patents of the same inventor for improvements in dippers, for immersing candies in chocolate solutions, and provides a cheap and easily applied cover for each pocket of a dipper to prevent the displacing of the drops or candies in the dipper during the dipping process, the cover being of an open structure, to not interfere with completely coating the articles. The cover offers but little surface for the accumulation of solidified chocolate, and readily closes or opens the pockets.

OIL CLOTH, ETC., CUTTER.—James W. Lewis and Sirus E. Kochendarfer, Hollidaysburg, Pa. For cutting oil cloth, linoleum, carpets, window shades, etc., these inventors provide a cutter of which the support has a straight edge with a rail on its upper surface, in connection with a U-shaped frame from one member of which projects a knife, a shoe being pivoted between the members of the frame and grooved to receive the rail of the support, while a handle projects from the top of the frame.

WAGON BRAKE ROD.—John W. Cook and Charles Scott, Woodburn, Oregon. This is an improvement in brake rods which have one end secured to the operating lever on the box and the other end to a lever on the running gear, the rod being quickly lengthened or shortened by an attachment consisting of two plates or jaws, one with studs and the other with apertures to receive the studs, there being a sleeve on the shanks of the plates or jaws to lock them together. By this means the brake rod can be easily and quickly removed to permit the removal of the box or body from the running gear.

LUBRICATOR FOR VEHICLE AXLES.—James C. Whisman and Louis F. Gerding, St. Joseph, Mo. According to this improvement the axle spindle has in its top a longitudinal tapering groove, in which fits a tapering bar with a head, and a nut on the spindle has an annular groove into which the head of the bar projects. The lubricant is applied to the bar before its insertion in the groove, and the bar presses the lubricant in contact with the journal or box in the hub of the wheel, it not being necessary to remove the latter from the axle.

NECKTIE.—Pozzo Camillo, New York City. According to this improvement the ends of the tie are passed through channels in a front clamping piece, covered with material similar to the tie, the dimensions of the channels and the elasticity of the clamping piece being designed to hold the clamping piece at any desired place, and the neckband being thus practically adjustable to different widths of bows or scarfs.

TROUSERS SUPPORTER.—Henry Shrier, New York City. This improvement is more especially designed for the use of riders of bicycles, horses, etc., and comprises a trunks supporter yieldingly secured to the waistband of the trousers, the trunks having short leg portions with elastic bands and elastic loops for closing side openings. The supporter is designed to support the abdomen irrespective of the movement of the leg portions of the trousers.

AWNING.—James S. Sanders, Durango, Col. A frame of curved bars, according to this improvement, is arranged across the window frames to serve as guides for vertical slide bars secured to the edges of the sections of the awning, one of which is secured at each side of the window opening. The awning sections are designed to be evenly opened and closed, as desired, by means of operating cords secured to the slide bars.

CRUDE OIL BURNER.—Thomas J. Brough, Baltimore, Md. For burning the heavier oils, this invention provides for a separation of the oil in the burner itself into a lighter and easily vaporized oil and a heavier oil to be drawn off and burned through a separate nozzle or otherwise utilized. The fire chamber is composed of a series of coils, a burner at the lower end discharging into a central space and there being a chamber for separating the light from the heavy oil in one of the convolutions of the coils, directly within the influence of the burner's heat, a pipe from such chamber leading away the heavy oil.

FENCE WIRE STRETCHER.—Hugh Robinson, Exeter, Neb. This device comprises a toothed bar, one end of which is connected by a chain to the post, there being fulcrumed on the outer end of the bar a hand lever on which is a clamping device to engage and clamp the wire to be stretched, a link connected with the hand lever engaging the teeth of the bar. The device is very simple, can be readily attached to the post at the desired height for the wire, and is easily manipulated by a single person.

GATE.—Orville M. Blood, Elburn, Ill. This gate may be opened or closed from either side by a person on horseback or in a vehicle. The invention provides a cheap and strong working mechanism, not liable to get out of order, there being on the gate a slide bar engaged by a keeper and also a bracket on the slide bar, while a brace is pivoted to the bracket and to the gate. Tilting connecting levers are arranged at right angles to the gate when closed, and an adjustable pull rod connects the levers and bracket.

Designs.

BUILDING BLOCK.—George H. Bodine, Zanesville, Ohio. This block is exteriorly of rectangular form, with plane uniform surfaces on five sides, while in its sixth side is a cylindrical pocket with concaved bottom.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS AND PUBLICATIONS.

LETTERING FOR DRAUGHTSMEN, ENGINEERS AND STUDENTS. A practical system of freehand lettering for working drawings. By Charles W. Reinhardt. New York: D. Van Nostrand Company. 1895. Pp. 23, Plates IX. Price $1.

The lettering of a drawing to many draughtsmen is the most difficult portion of the work. Successful letterers work by freehand. The author of this manual designs it for practical work, and therefore for freehand lettering, and we feel that it will be acceptable to many as embodying an excellent system of teaching and of learning this somewhat difficult art.

CHEMICAL TECHNOLOGY; or, Chemistry in its Application to Arts and Manufactures. Edited by Charles Edward Groves, F.R.S., and William Thorp, B.Sc. Vol. II. Lighting. Fats and Oils. By W. Y. Dent. Stearine Industry. By J. McArthur. Candle Manufacture. By L. Field and F. A. Field. The Petroleum Industry and Lamps. By Boverton Redwood. Miners' Safety Lamps. By B. Redwood and D. A. Louis. Philadelphia: P. Blakiston, Son & Company, 1012 Walnut Street. 1895. Pp. xvi, 398. Price $4.

This second volume of chemical technology, now issuing from the press of P. Blakiston, Son & Company, is devoted to lighting, covering fats and oils, the stearine industry, candle manufacture, petroleum industry and lamps, and miners' safety lamps. All we can say of it is that it is so thorough in its treatment and so complete that it is quite futile for us to attempt to review it. The single volume of about 400 pages contains, on the average, nearly one cut for each page. Its contents and list of illustrations alone take nearly ten pages, while an excellent index closes the work. It forms the second volume of the technology, of which the third volume is nearly ready. The first volume has been devoted to fuel and its applications. The third one will be devoted to

gas and electric lighting, illumination and photometry. In the present volume, Mr. Boverton Redwood's treatise on petroleum industry and lamps cannot be too highly commended as being of immediate interest, especially in this country.

L'OR. Propriétés Physiques et Chimiques — Gisements — Extraction — Applications — Dosage. Introduction de M. U. Le Vernier. Avec 67 figures intercalées dans le texte. Propriétés Physiques et Chimiques Gisements, Gisements filconiens — Gisements sédimentaires Alluvions auriferes. Extraction Applications. Orfévrerie — Médailles — Monnaies. Dosage. Essai des minerais — Essai des alliages. Paris: Librairie J. B. Baillière et fils. 1896. Pp. 420. Price $1.

This nicely illustrated and well printed monograph treats of the entire subject of gold, from its mining and metallurgy to the analysis of its ores. The absence of an index is made of but small moment by the presence of a very full table of contents. The house of Baillière have done a great service to science in the very extensive series of monographs which they have issued, and the present will be accepted as by no means the least important of their series.

HEATING AND VENTILATING BUILDINGS. An elementary treatise. By Rolla C. Carpenter. New York: John Wiley & Sons. London: Chapman & Hall, Limited. 1895. Pp. xiii, 411. Price $3.

This excellent and serious work, with numerous illustrations, tables and data, treats systematically of the subject of heating modern buildings by all methods, including even heating with electricity. We note that the expense of electrical heating receives due consideration, the necessarily low efficiency of the system when the electricity is generated by steam plants militating strongly against its use. While we feel that the entire book deserves great commendation, and while it really fills a void in technical literature, we would refer to the section devoted to electrical heating as an indication of the thoroughness and conservatism of treatment. Immediately preceding the excellent index is a series of twenty-one tables of different data to be used by the engineer.

Business and Personal.

The charge for Insertion under this head is One Dollar a line for each insertion: about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in the following week's issue.

Whereas, the copartnership heretofore existing in the City and State of New York between Orson D. Munn and Alfred E. Beach, under the copartnership name of Munn & Co., and having its principal place of business at No. 361 Broadway, in the City and State of New York, has been dissolved by the death of Alfred E. Beach on January 1, 1896; and

Whereas, the said copartnership had business relations with foreign countries and transacted business in the State of New York for a period of five years and upward; and

Whereas, I, Orson D. Munn, the surviving copartner, am desirous to continue the business conducted by the said copartnership and to continue the use of the name of Munn & Co.

Now, I, Orson D. Munn, do hereby certify and declare that I am the person dealing under such name of Munn & Co., and that my place of abode is 14 East Twenty-second Street, City of New York, and that my principal place of business is at No. 361 Broadway, in the City and State of New York.

(Signed) ORSON D. MUNN. [L.S.]

In presence of
A. A. HOPKINS.

City and County of New York, ss:

On this 6th day of January, in the year 1896, before me personally came Orson D. Munn, to me known to be the individual described in and who executed the foregoing instrument and acknowledged to me that he executed the same for the purposes therein mentioned.

(Signed) A. A. HOPKINS,
[L.S.] Notary Public,
Kings County, New York.

Certificate filed in New York County.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(6700) W. A. E. says: Please inform me through the columns of the SCIENTIFIC AMERICAN what ingredients are used in making flash light powder for use in photography, and how it is prepared. A. Magnesium powder, 6 ounces; potassium chlorate, 12 ounces; antimony sulphide, 2 ounces; 75 to 150 grains of the powder should be used. 2. 15 grains of gun cotton and 30 grains of magnesium powder are used.

3. Magnesium	40	per cent.
Permanganate of potassium	40	"
Peroxide of barium	20	"

4. Purchase 1 ounce of magnesium powder and 1 ounce of negative gun cotton from dealers in photographic materials. Place on a dust pan enough cotton, when pulled out, to measure about 3½ inches in diameter. Sprinkle it over with 20 grains of magnesium powder to form a thin, even film. Lay over the magnesium thus arranged a very thin layer of gun cotton. Connect to the bunch of cotton a small fuse of twisted cotton about 6 inches long, so that it will extend to the side of the dust pan. Then set the pan on a step ladder near the object, and when ready, light the gun cotton fuse with a match, when instantly a brilliant flash will ensue. There are several ready prepared magnesium compounds now sold with special devices and lamps to fire them.

(6701) C. W., Ontario, Canada, asks for simple method of testing drinking water. A. General. Evaporate by gentle heat a small sample of the water nearly to dryness in a clean porcelain cup, moisten the residue with acetic acid, and add to a portion of it a few drops of strong hydrosulphuric acid—pure water saturated with the gas evolved by the action of dilute sulphuric acid on iron monosulphide; a black precipitate indicates lead. Add to another portion of the dilute acetic acid solution a little pure hydrochloric acid; a white precipitate which redissolves on diluting with boiling water indicates lead. To the remainder of the solution add a few drops of dilute sulphuric acid and let it stand for a time; a white, heavy precipitate indicates lead. 1. Test for Hard or Soft Water.—Dissolve a small quantity of good soap in alcohol. Let a few drops fall into a glass of water. If it turns milky, it is hard; if not, it is soft. 2. Test for Earthy Matters or Alkali.—Take litmus paper dipped in vinegar, and if, on immersion, the paper returns to its true shade, the water does not contain earthy matter or alkali. If a few drops of sirup be added to a water containing an earthy matter, it will turn green. 3. Test for Carbonic Acid.—Take equal parts of water and clear lime water. If combined or free carbonic acid is present, a precipitate is seen, in which, if a few drops of muriatic acid be added, an effervescence commences. 4. Test for Magnesia.—Boil the water to a twentieth part of its weight, and then drop a few grains of neutral carbonate of ammonia into a glass of it and a few drops of phosphate of soda. If magnesia be present, it will fall to the bottom. 5. Test for Iron.—a. Boil a little nutgall and add to the water. If it turns gray or slate black, iron is present. b. Dissolve a little prussiate of potash, and, if iron is present, it will turn blue. 6. Test for Lime.—Into a glass of water put two drops of oxalic acid and blow upon it. If it gets milky, lime is present. 7. Test for Acid.—Take a piece of litmus paper. If it turns red, there must be acid. If it precipitates on adding lime water, it is carbonic acid. If a blue sugar paper is turned red, it is a mineral acid.

(6702) Engineer writes: Would it require more power to propel a fan in a cylinder in which there was compressed air than it would in the same cylinder with the air pumped out? Or, in other words, would the compressed air offer any resistance to the fan? A. Any medium that the fan revolves in offers a resistance due to the pressure of driving the medium forward, as well also to the friction of the blades, proportional to the density of the medium. Thus a vacuum may be said to have no resistance, while air at atmospheric pressure and when compressed resists the motion of fans in proportion to its density at various pressures.

(6703) G. G. C. writes: Your answer to G. G. C. in the last edition is good so far as it goes, but if it is not asking too much, I would like to ask one or two more questions. 1. Does temper or thickness in the bell of a steam whistle affect the sound? A. Not materially. 2. Are the air waves causing the sound produced by the vibration of the metal of which the bell is made, or by the interrupted exit of steam? A. By the fluttering of the issuing steam mainly.

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AND EACH BEARING THAT DATE.

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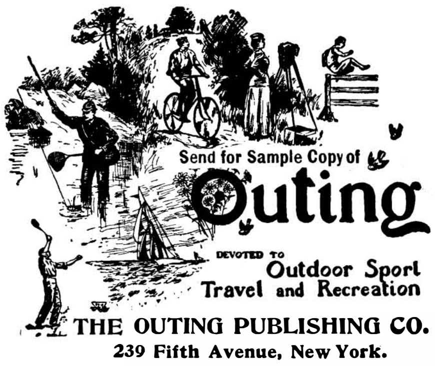

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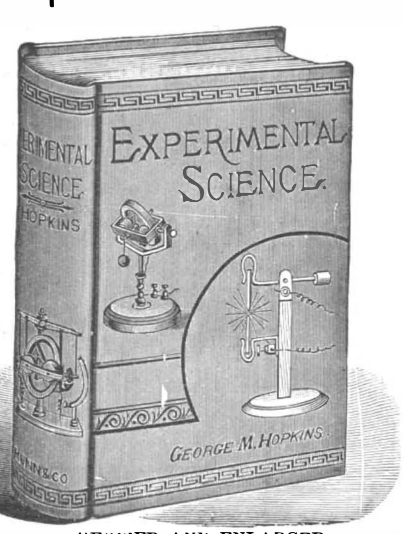

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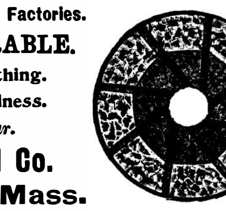

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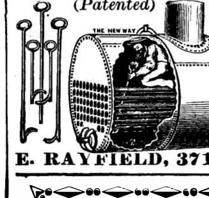

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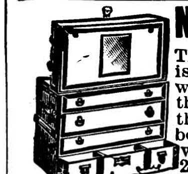

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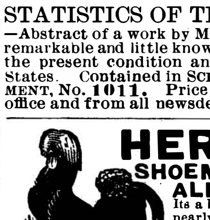

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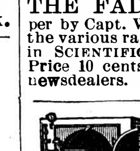

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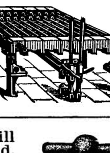

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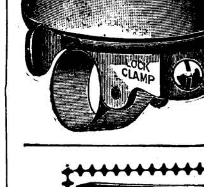

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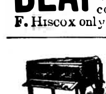

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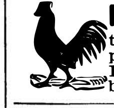

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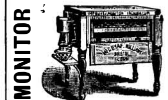

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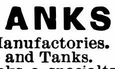

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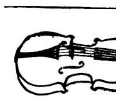

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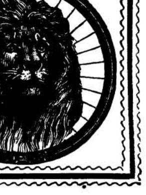

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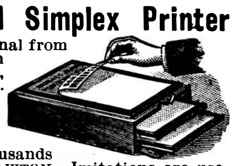

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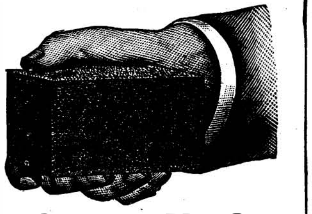

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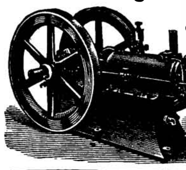

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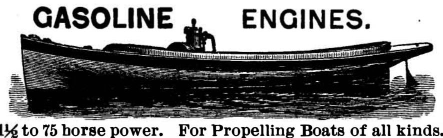

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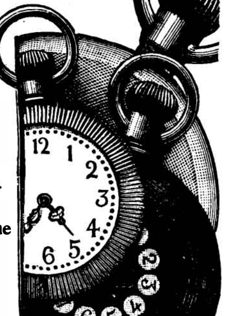

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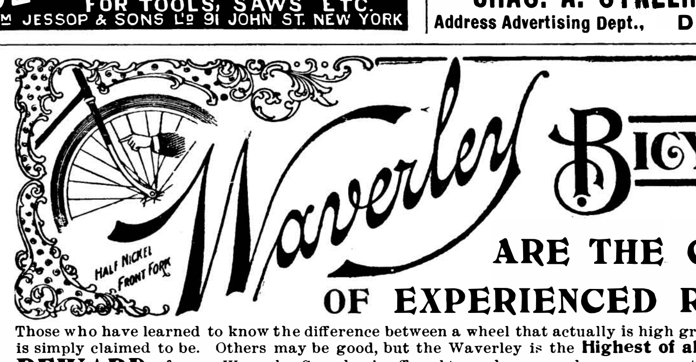

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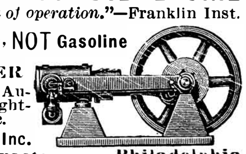

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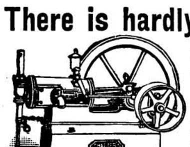

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